MicroBooNE Cosmic Ray Tagger Installation Review

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on behalf of the CRT team

Friday, May 6, 2016

Fermilab

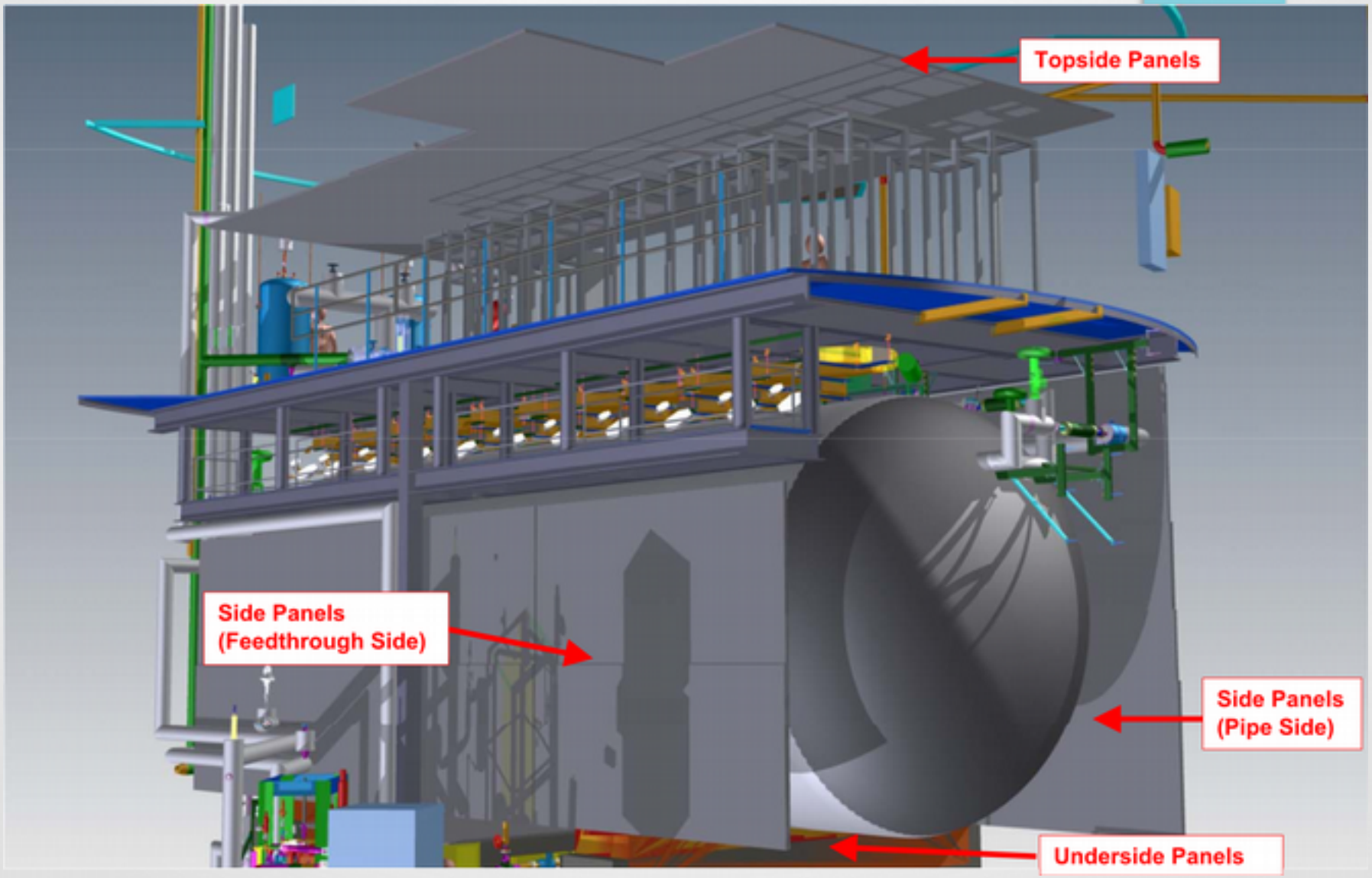
Cosmic Ray Tagger Installation Review

- Who will be doing the installation?
- Who is in charge (task manager?)
- How long will it take?
- Is there a written plan?
- Does the plan involve any welding?
- How have all of the potential safety issues being addressed?
- What personnel resources from Fermilab are required for the installation?

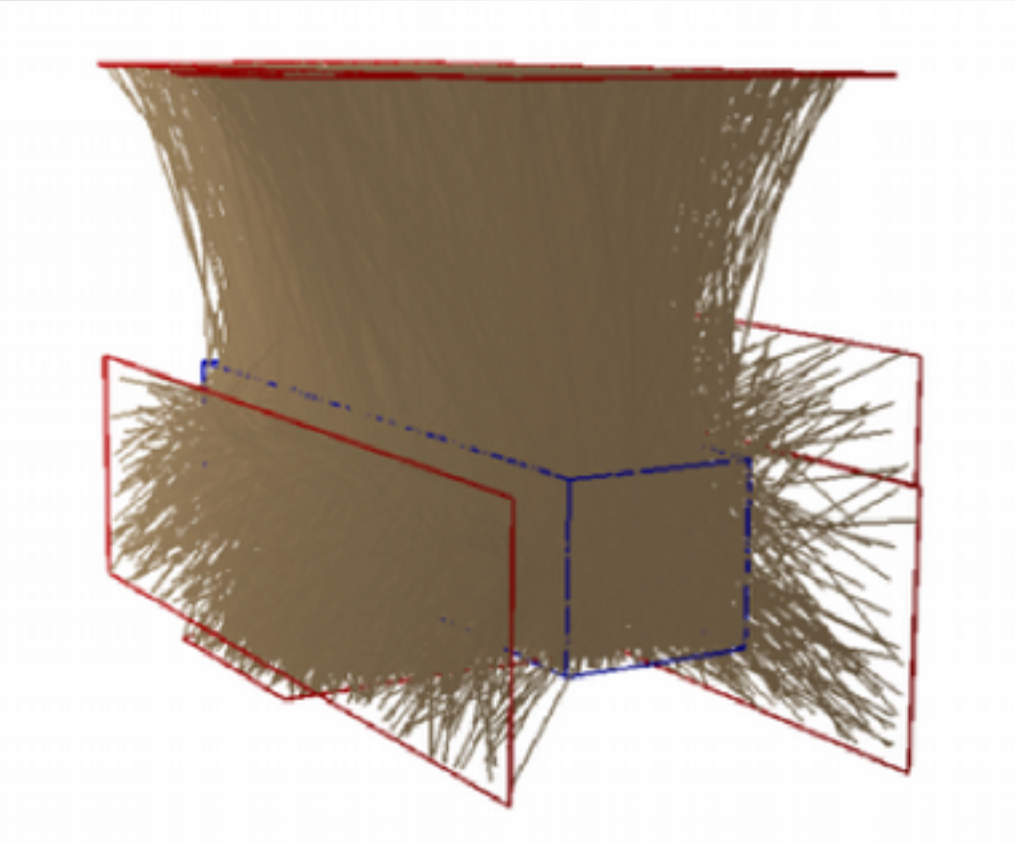
Cosmic Ray Tagger (CRT) Installation

- General overview of what the tagger is.
- Quick explanation of what a module is.
- Details on the subsections of the CRT:
  - Phase A:
    - Underside
    - Two walls
  - Phase B:
    - Topside
- Organization, scheduling, safety.

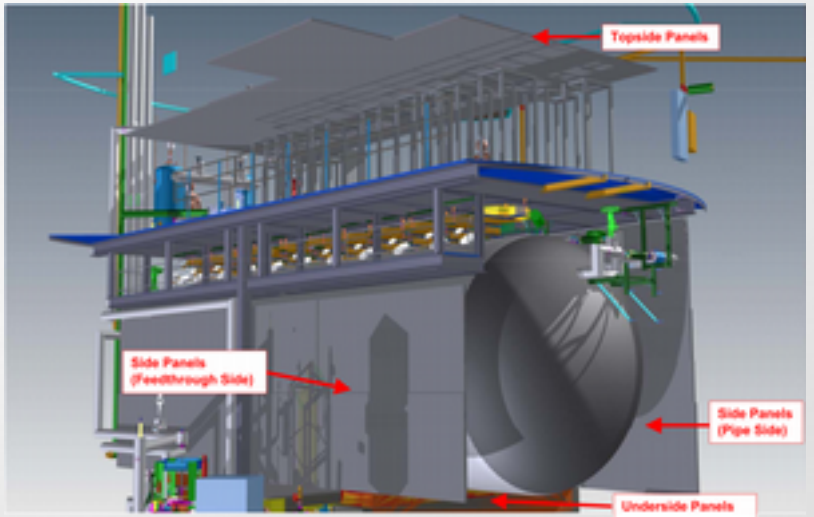
Overview of the CRT



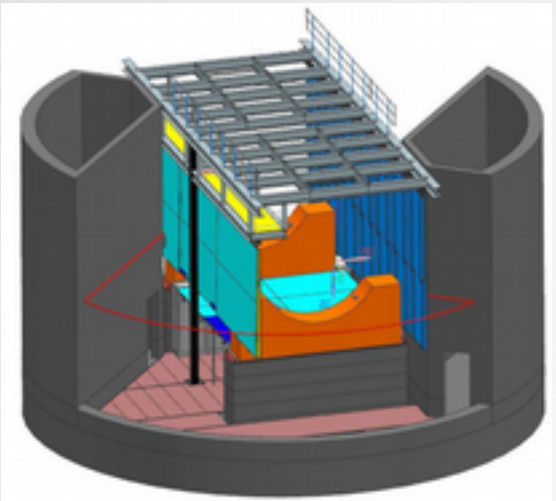
Overview of the CRT

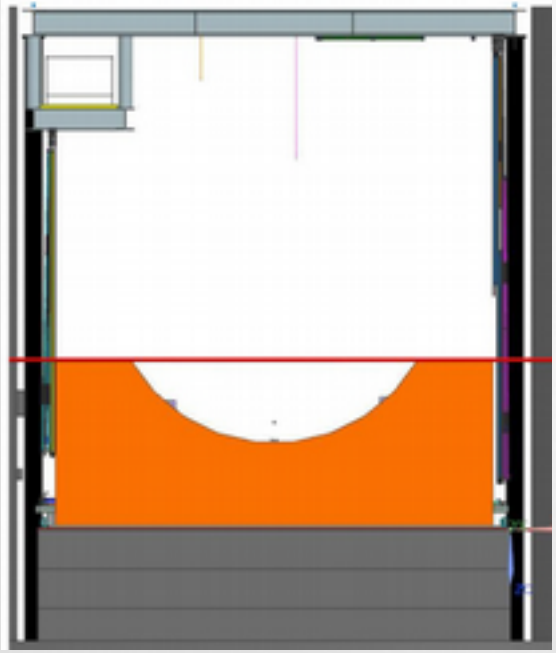


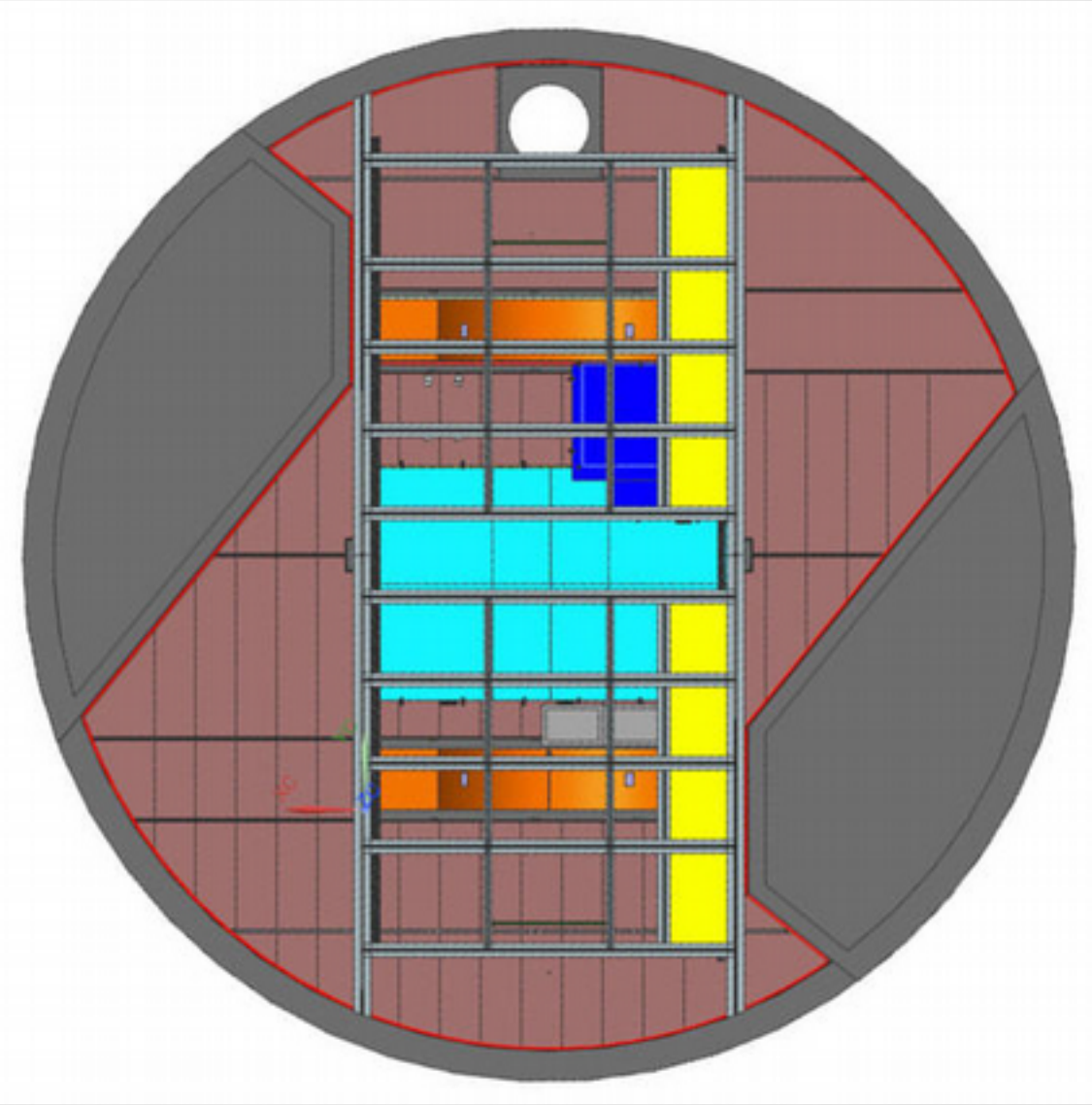
- Four separate parts:
  - Bottom
  - 2 sides
  - Top
- Total geometrical coverage: ~85%



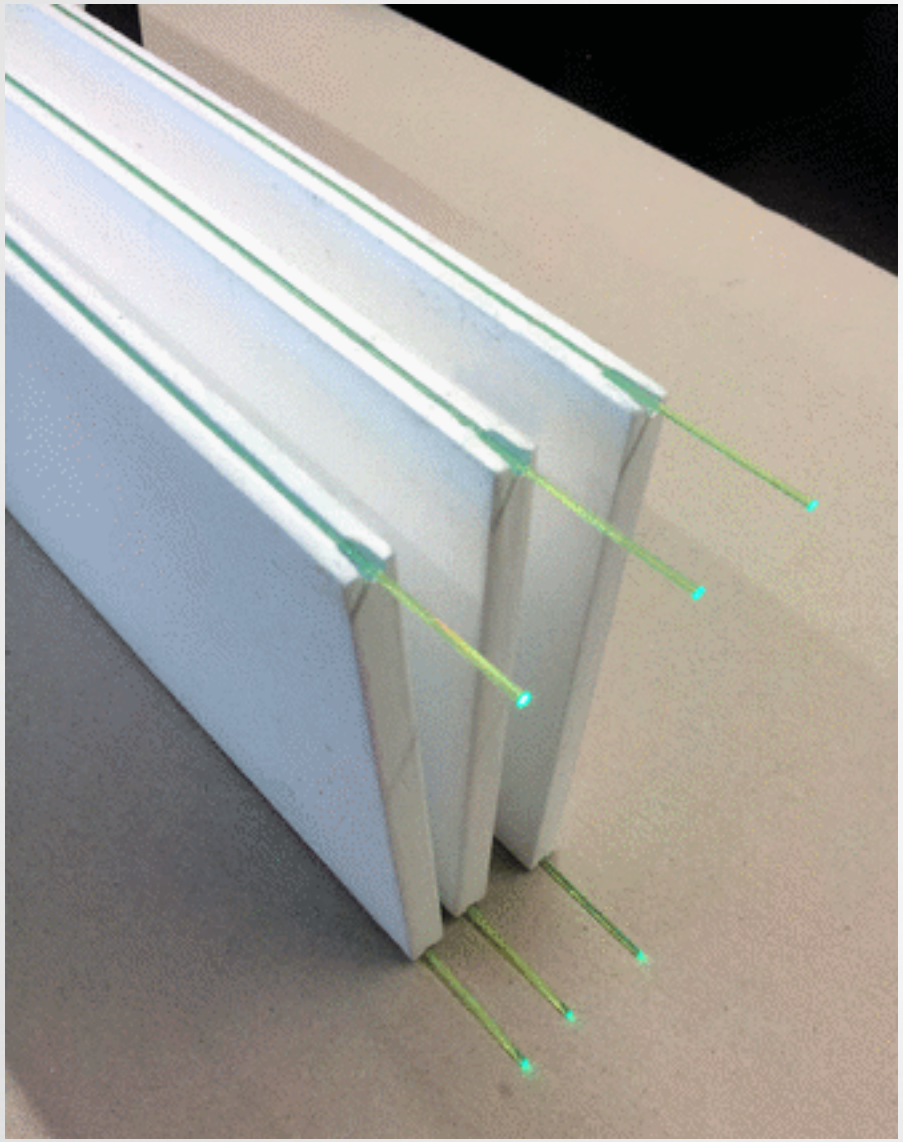
Overview of the CRT







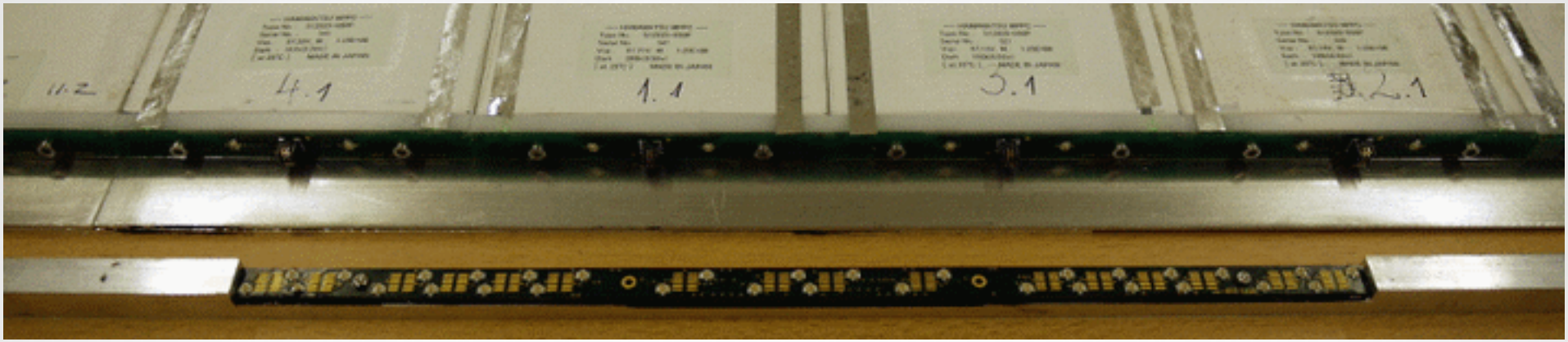
CRT building block: the module

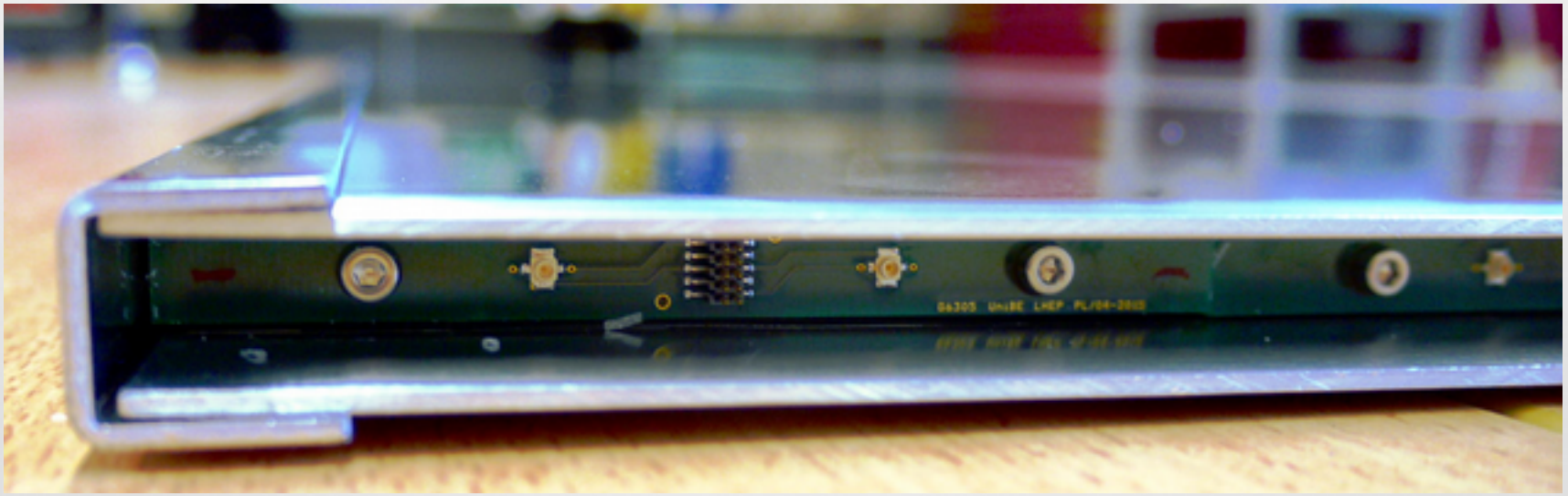


- Plastic scintillator slats, 10.8cm wide.
- Since they are extruded, length is made to order (<5m, by manufacturer limitation)
- Kurarai Y11 wavelength shifting fibres on each side.
- Fibre readout by Hamamatsu MPPC.

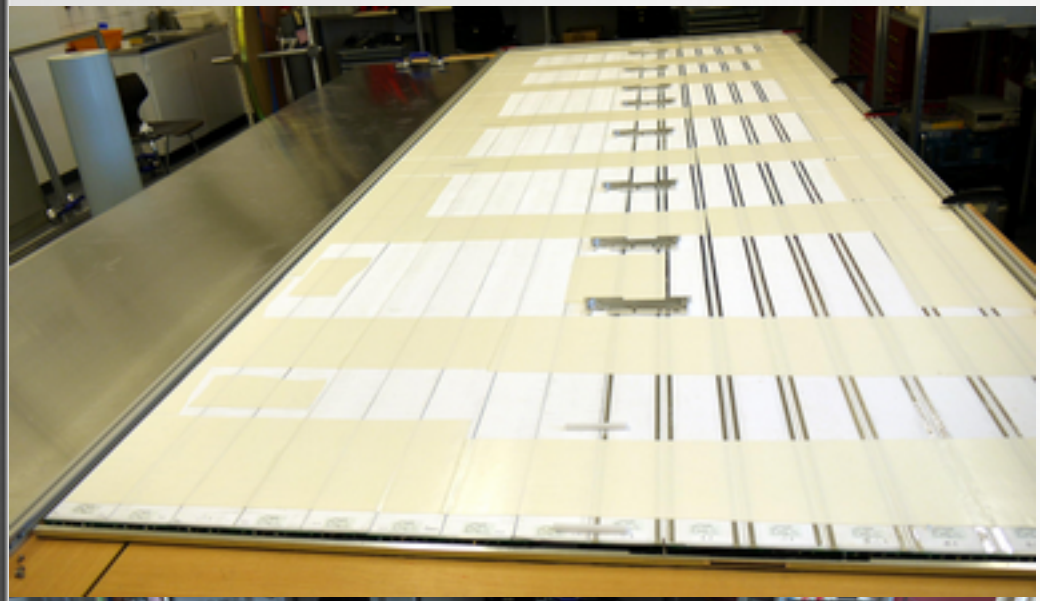
CRT building block: the module

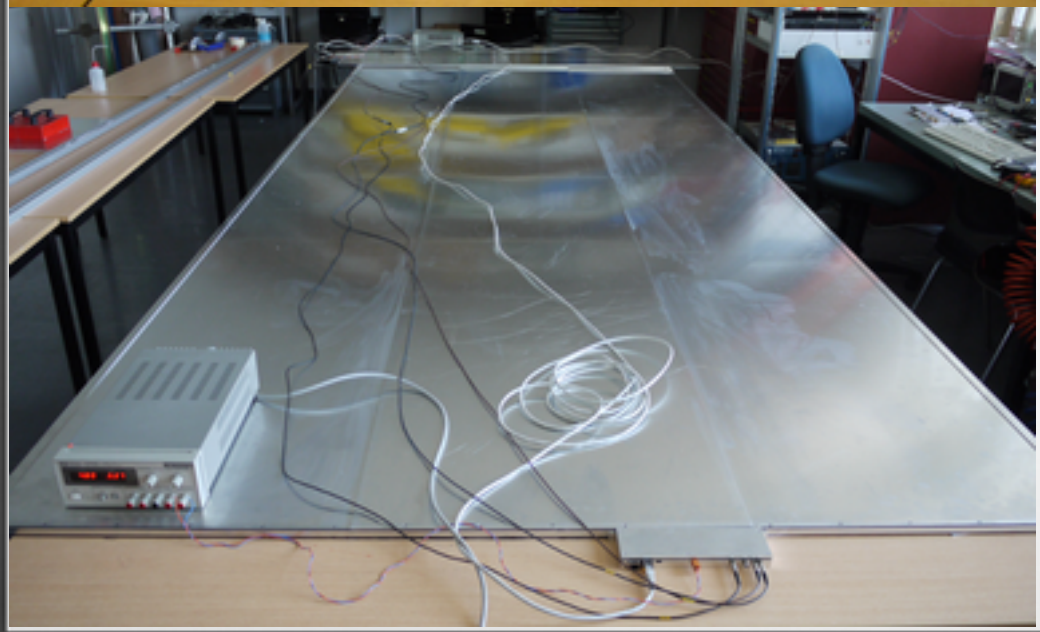
- 16 slats to a module.
- 32 channels per module.





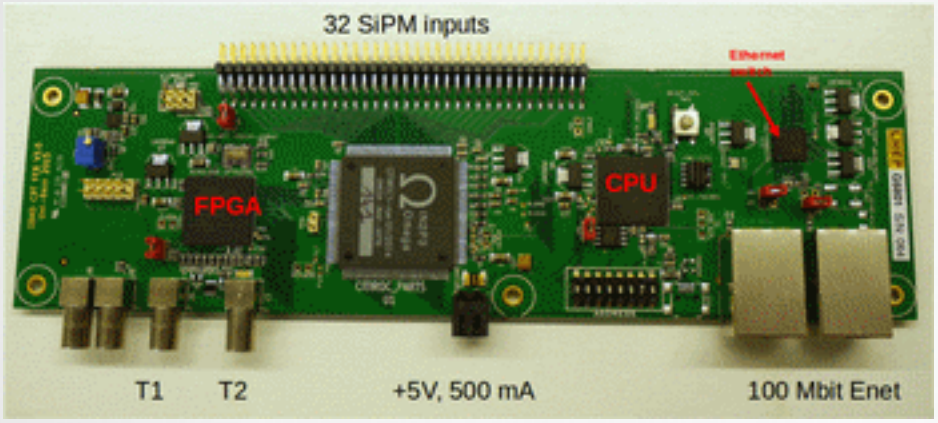
CRT building block: the module





- Slats are eclosed in 2mm thick aluminium sheets.
- Slats adhere to aluminium with double-sided epoxy foam tape.
- Aluminium sheets and edges glued with industrial elastic sealant.
- Completely light-tight

CRT building block: the module



- Readout electronics attached at one short edge.
- Attached asymetrically to define chanel orientation.
- Completely designed by Igor Kreslo in Bern.
- Passed Fermilab engineering review.
- Now licenced to CAEN.

CRT design consideration

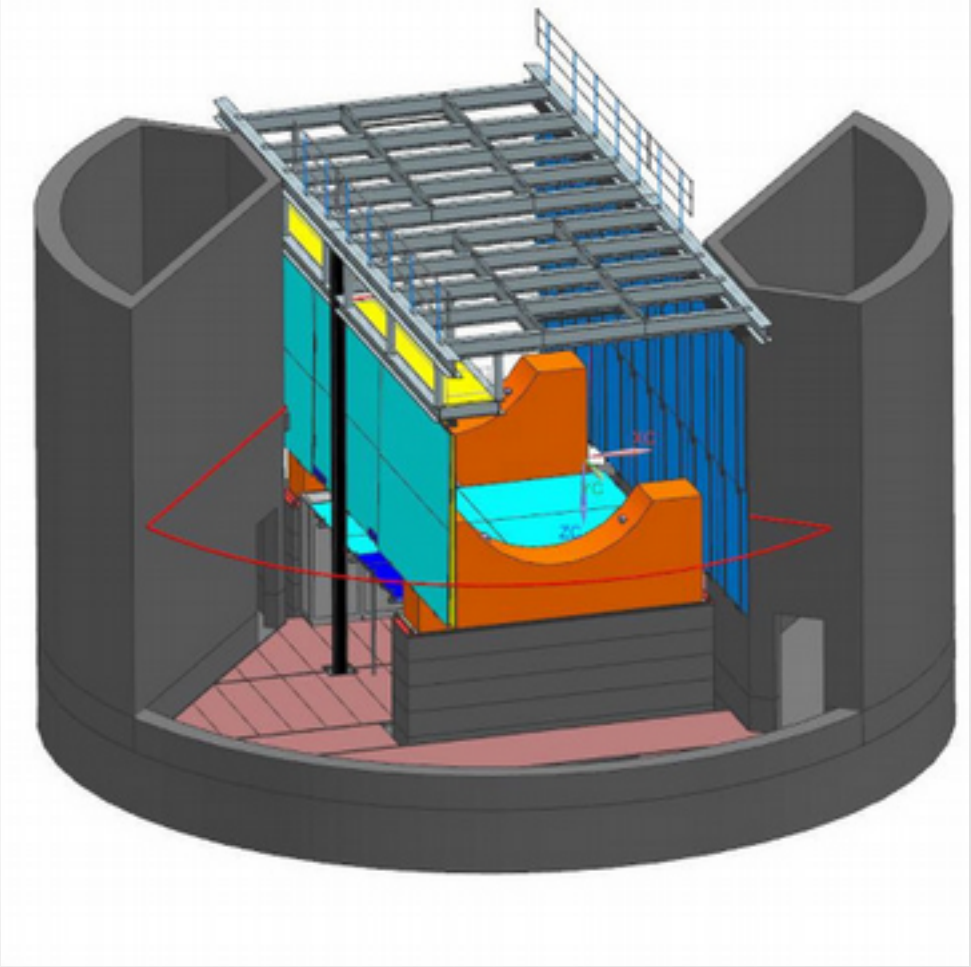
The design is subject to a long list of conditions that have all be satisfied simultaniously:

- All dimensions must be a multiple of a module width:
  - Required to have two layers of orthogonal slats to have position information.
- Leave access to electronics boxes possible (as much as possible...)
- Maximize geometrical coverage without interference with any existing systems.

CRT: Phase A

This phase consists of 49 modules separated into 3 sections and an extra structure:

- Underside:
  - Unistrut support table
  - 9 modules
- Feedthrough wall:
  - Unistrut rails to hang modules
  - 13 modules
- Pipe wall:
  - Unistrut rails to hang modules
  - 27 modules
- Topside:
  - Unistrut and C-profile table

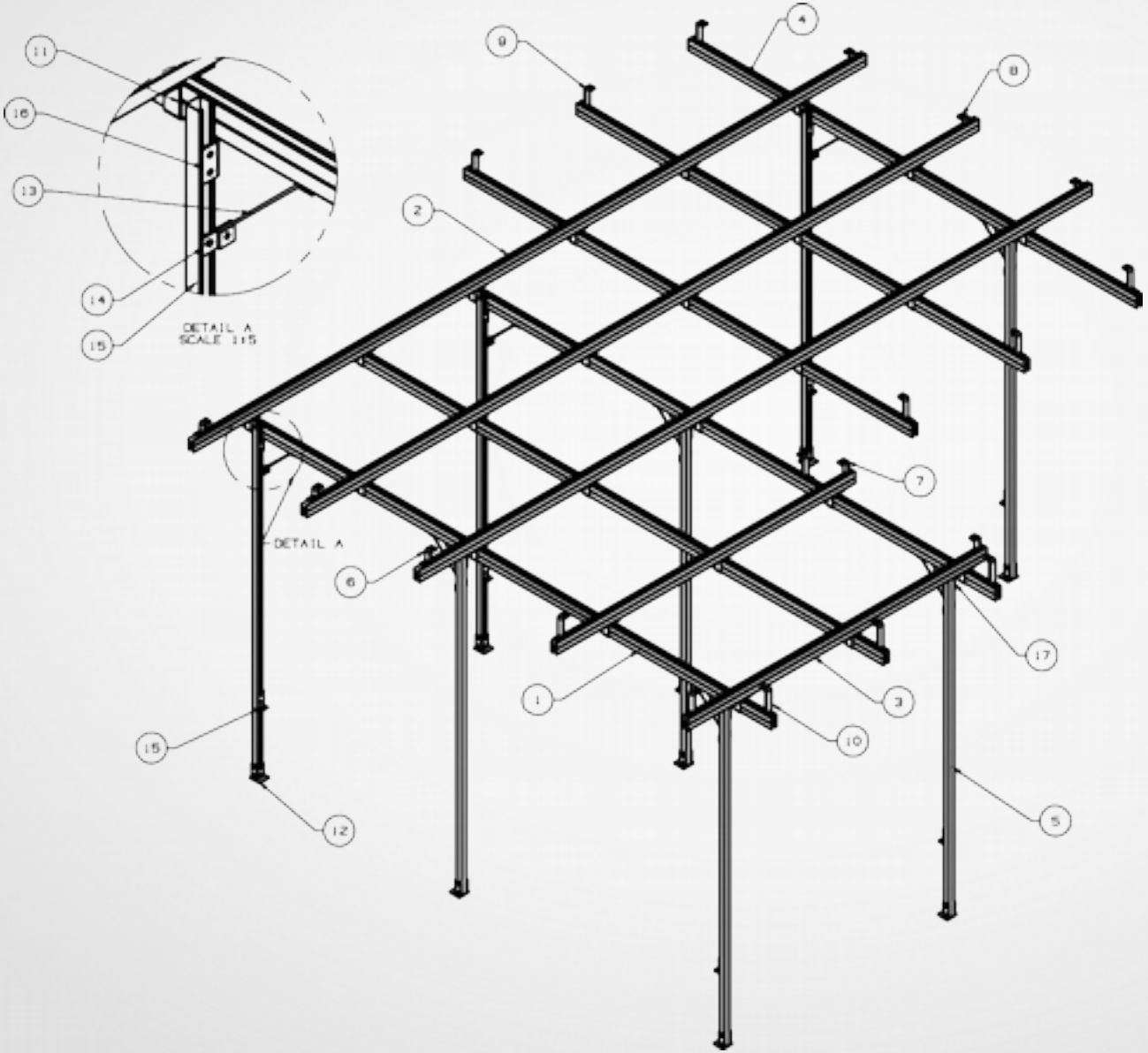


CRT: Phase A: Underside

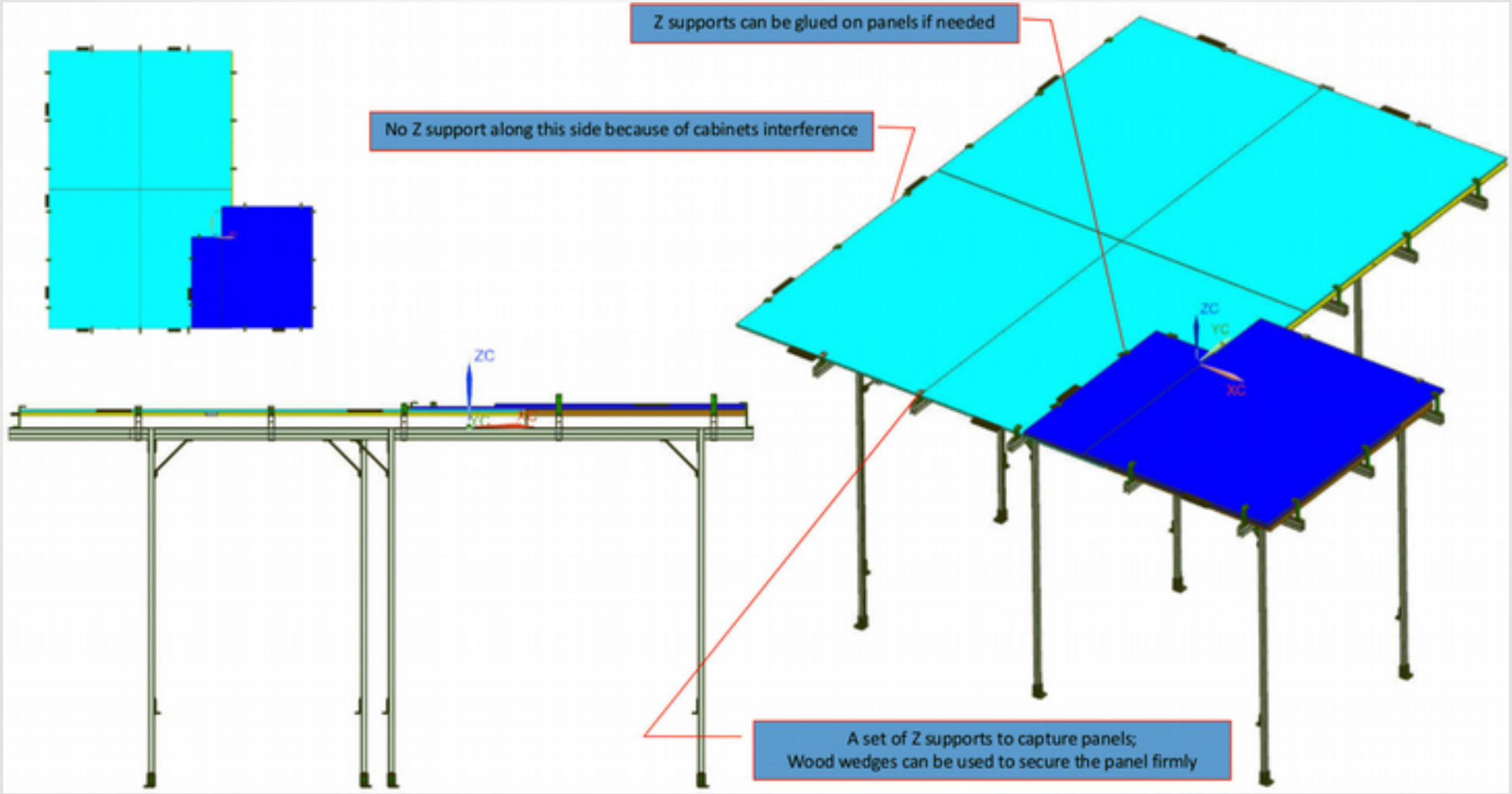
Smallest and mechanically simplest section.

- Work can start on the installation of the bottom structure and panels before shutdown without interference with operations.
- All under the tank – No work at height.
- Modules cover most of the area between the saddles that support the tank.

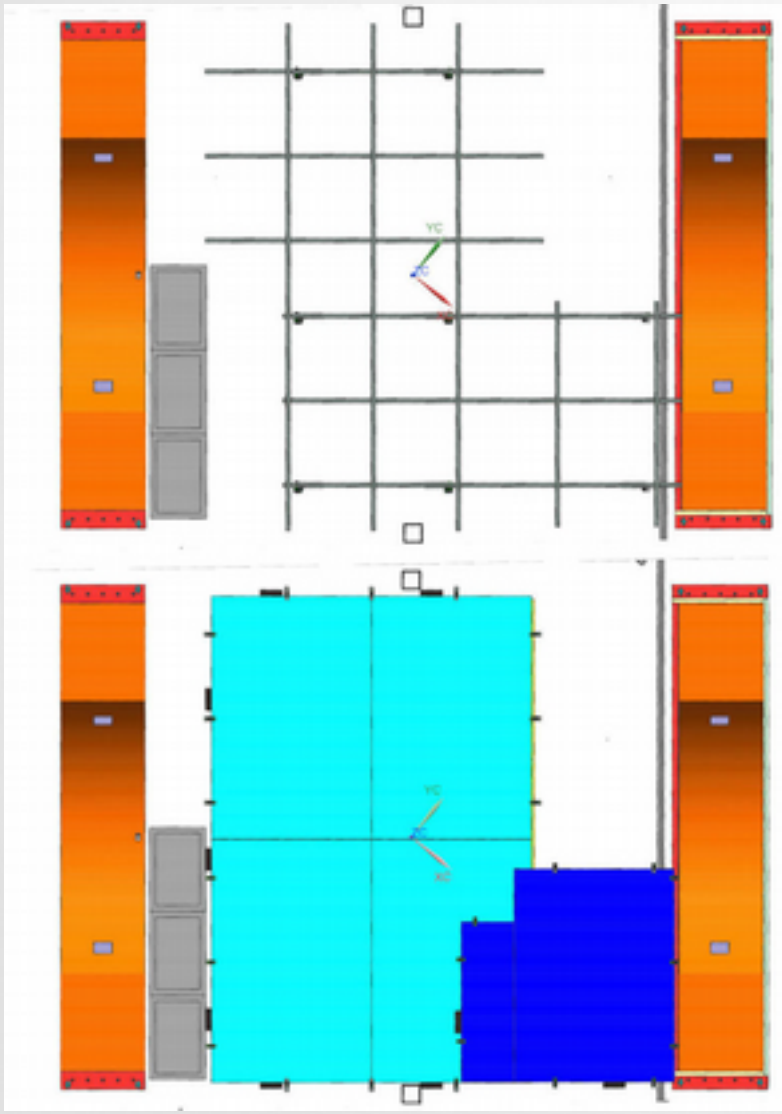
CRT: Phase A: Underside

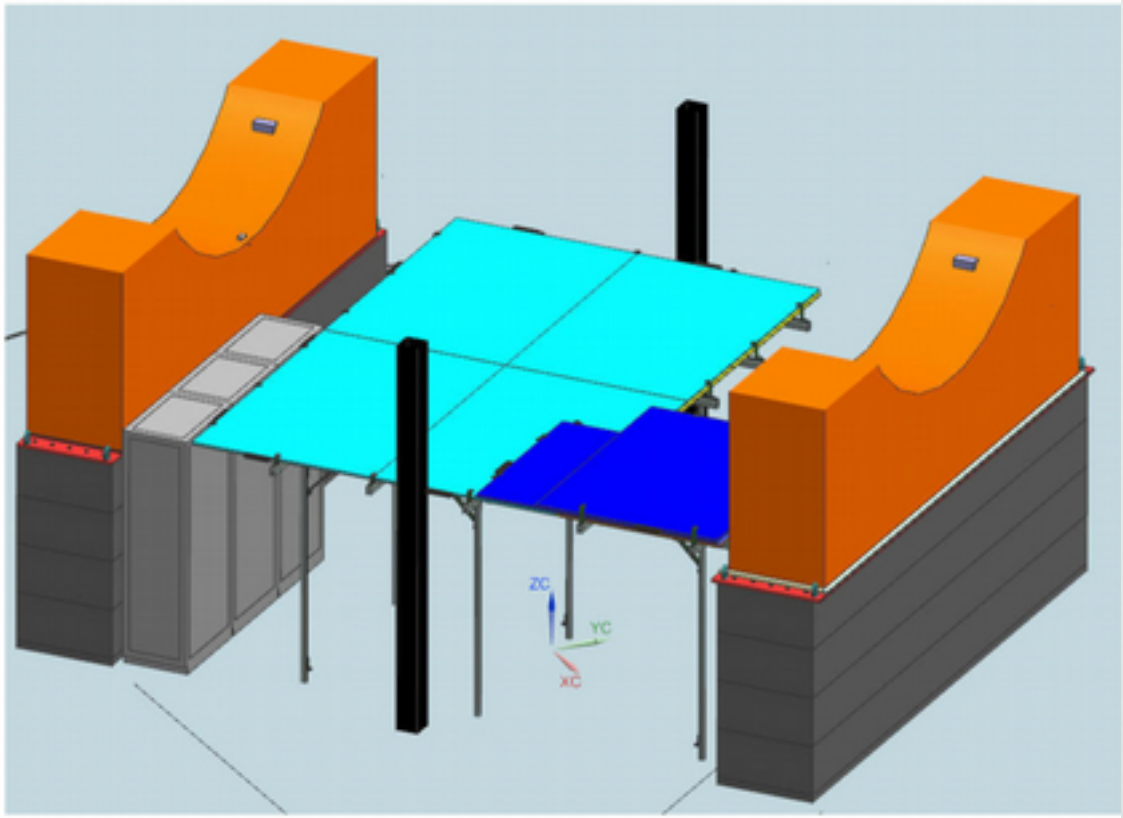


CRT: Phase A: Underside

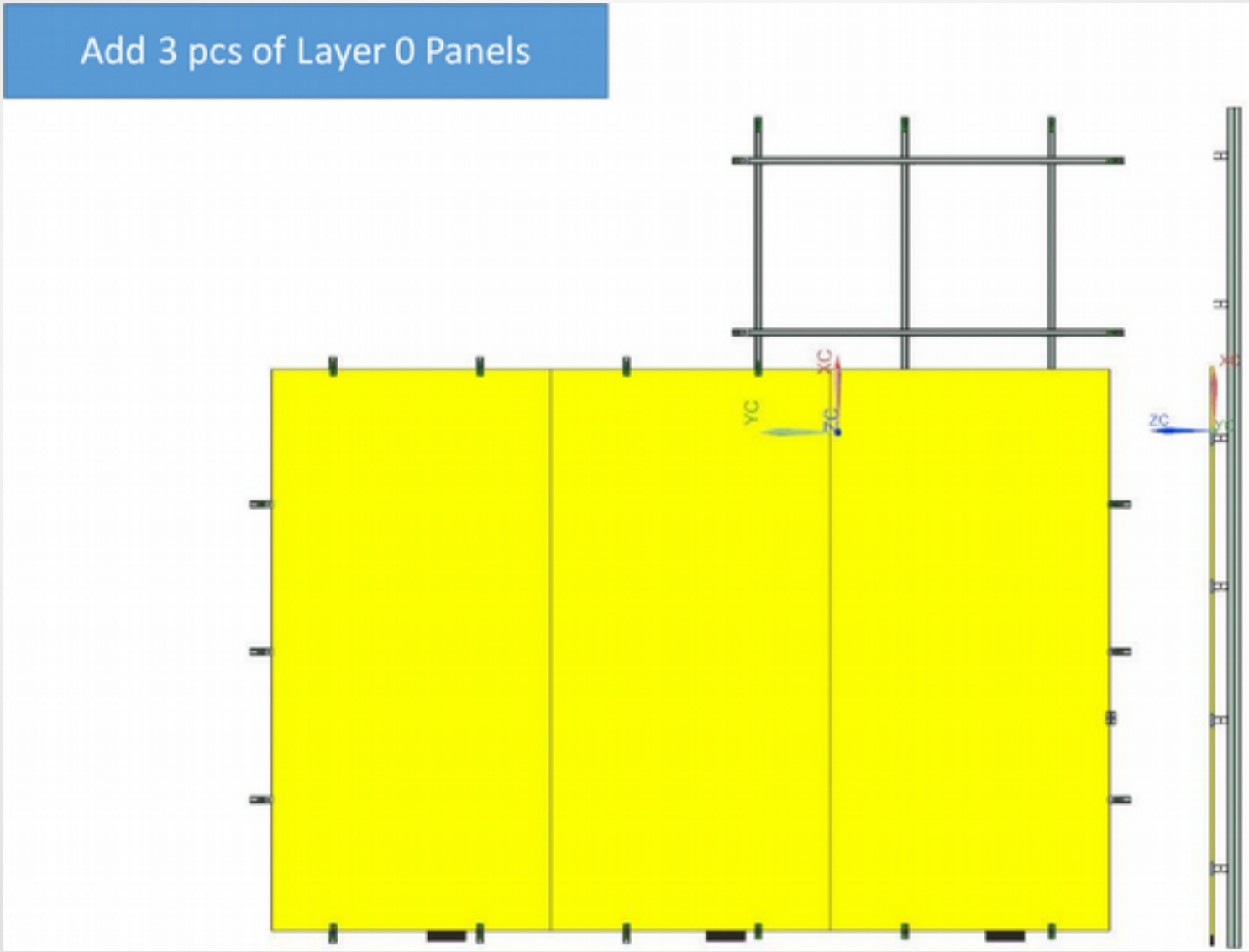


CRT: Phase A: Underside



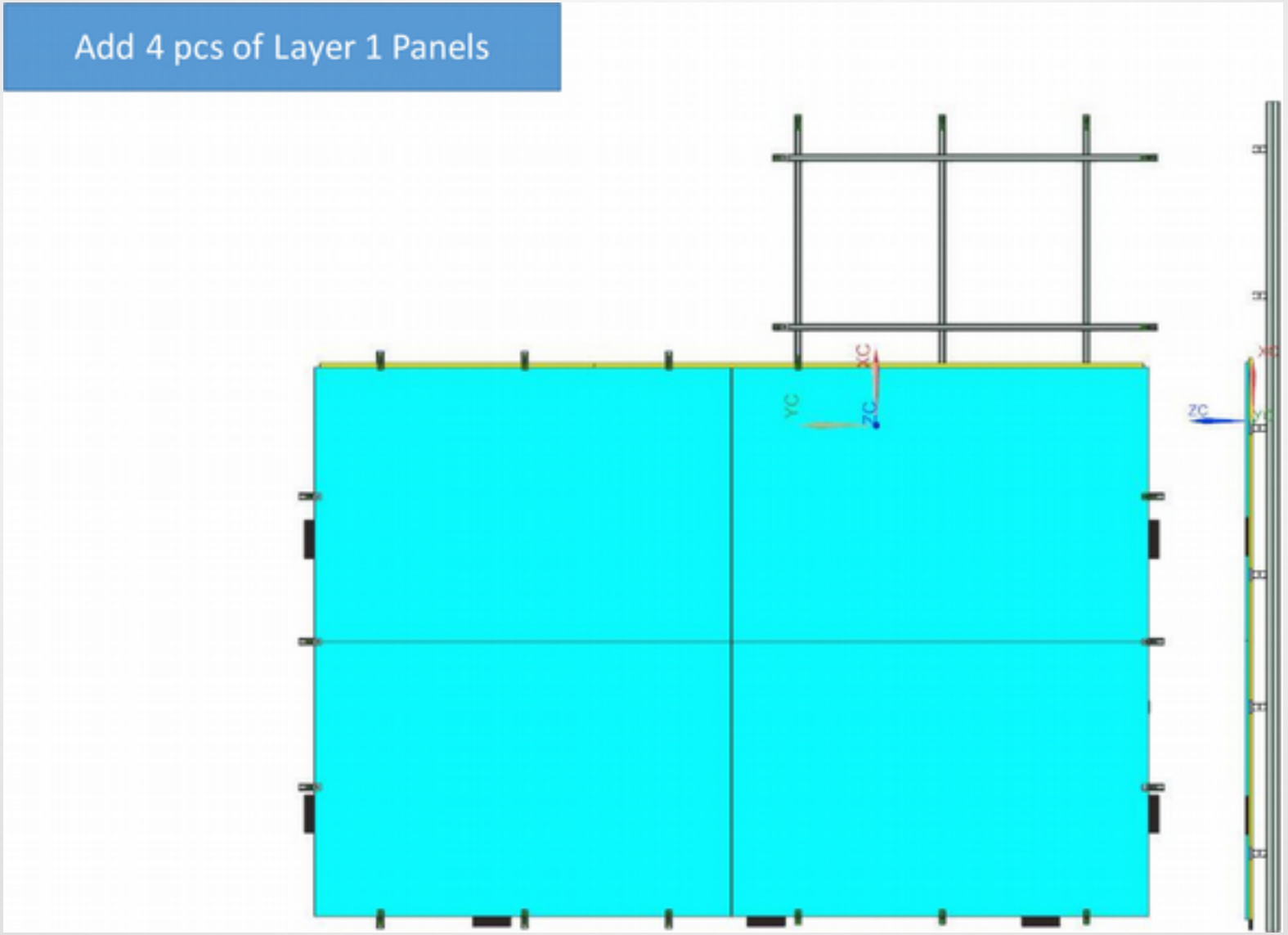


CRT: Phase A: Underside: Installation



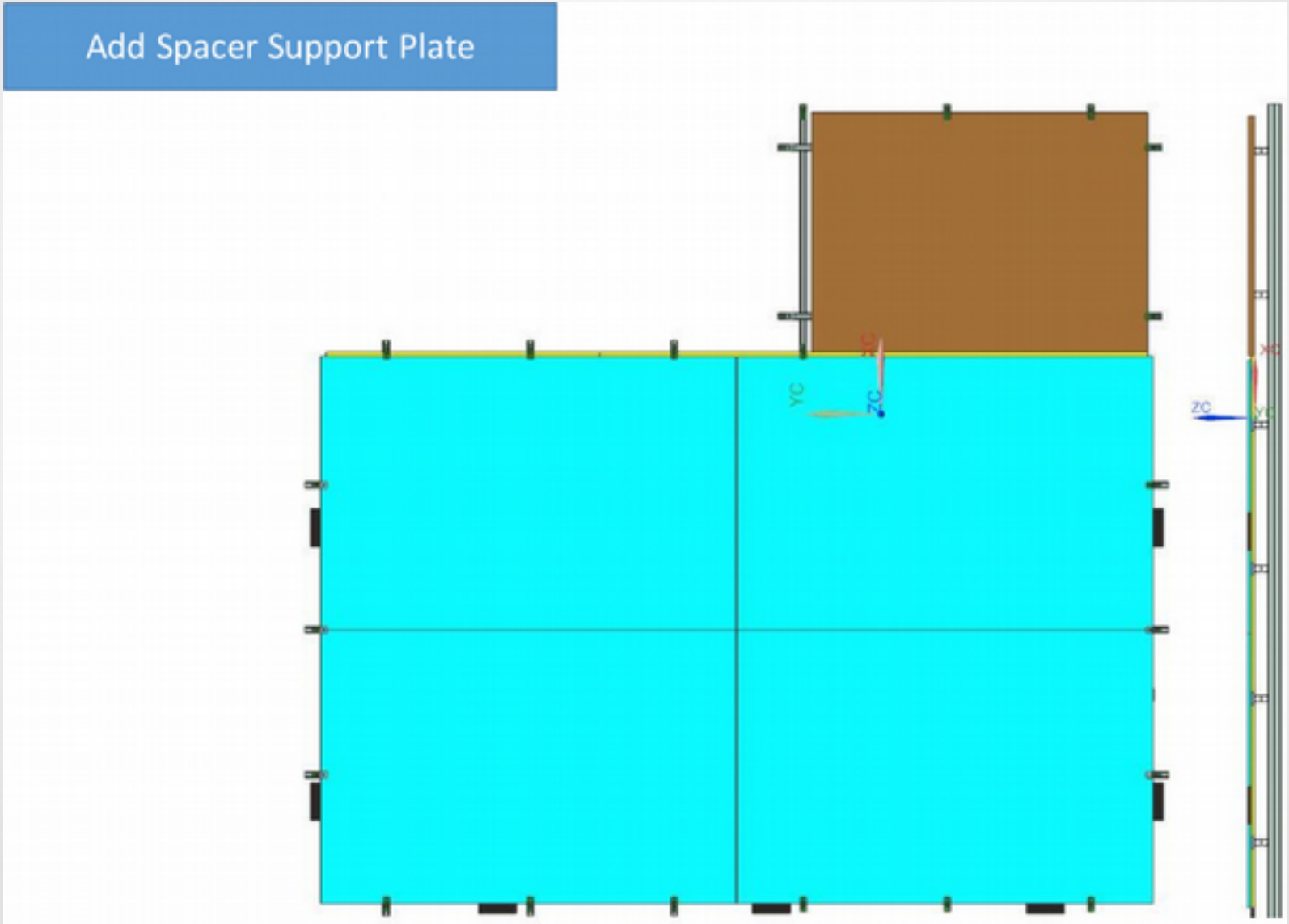
CRT: Phase A: Underside: Installation

Add 4 pcs of Layer 1 Panels

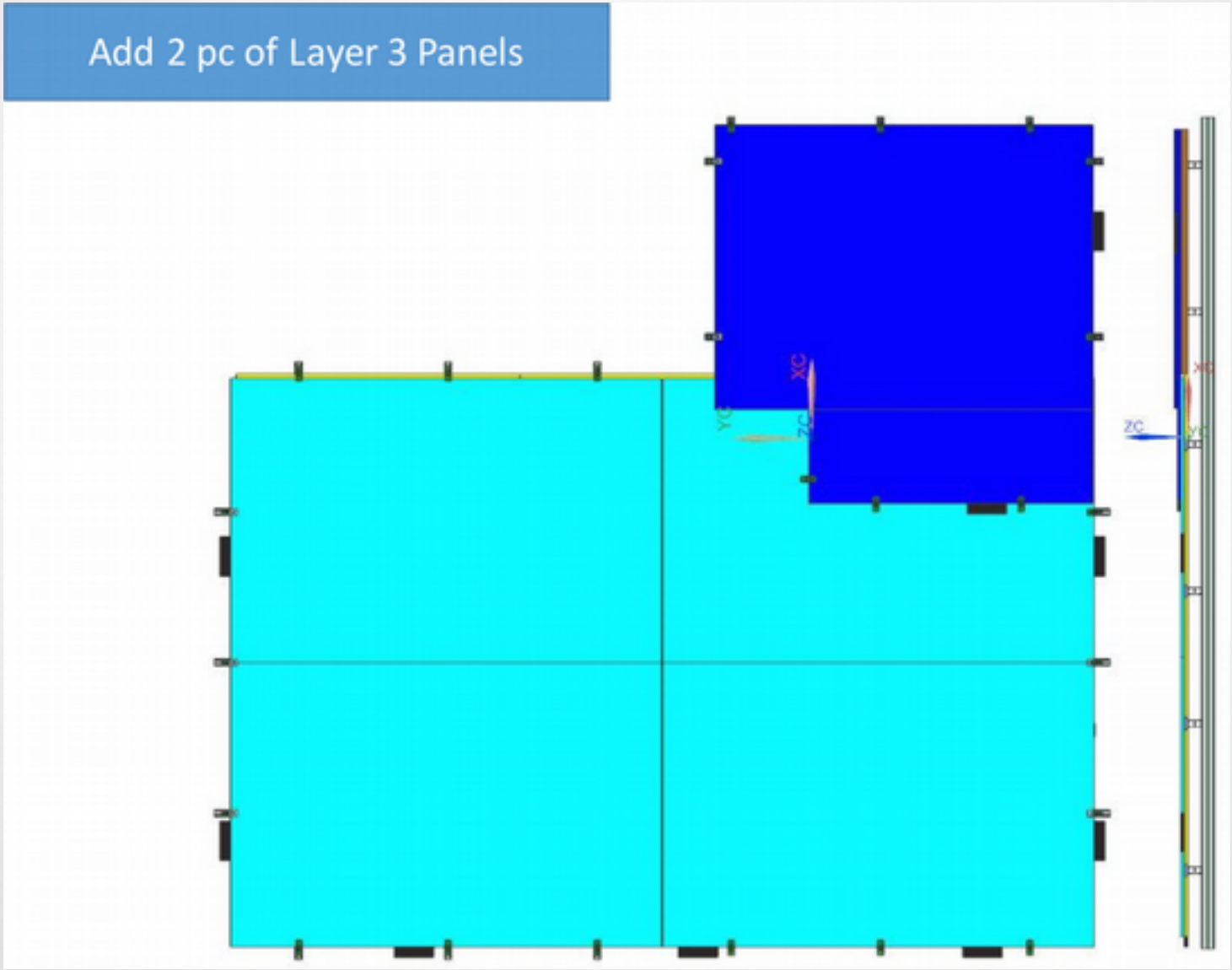


CRT: Phase A: Underside: Installation

Add Spacer Support Plate



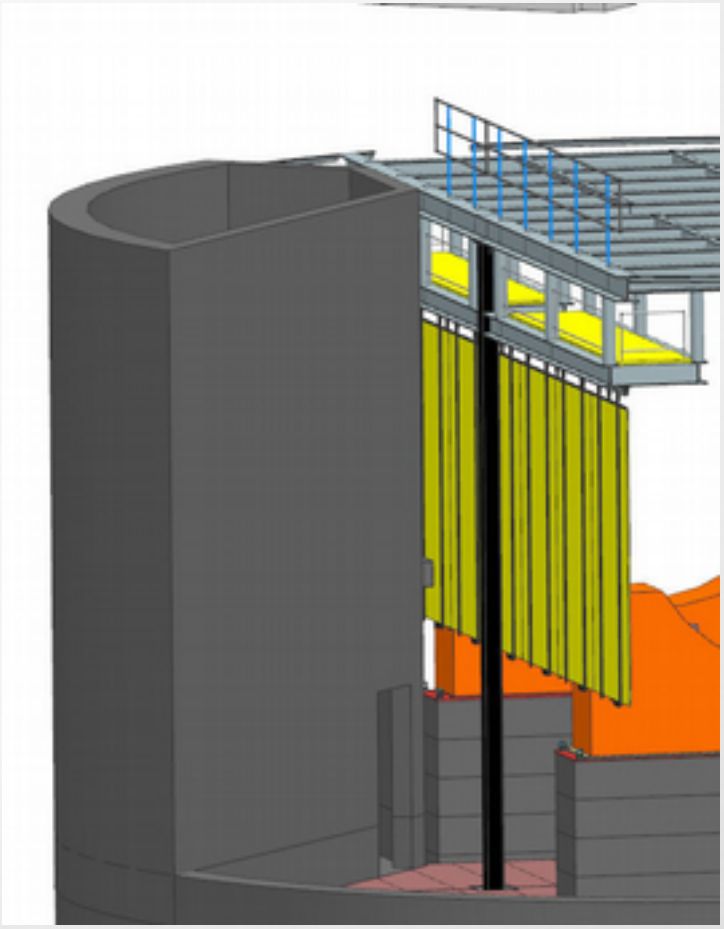
CRT: Phase A: Underside: Installation



CRT: Phase A: Walls: Strategy

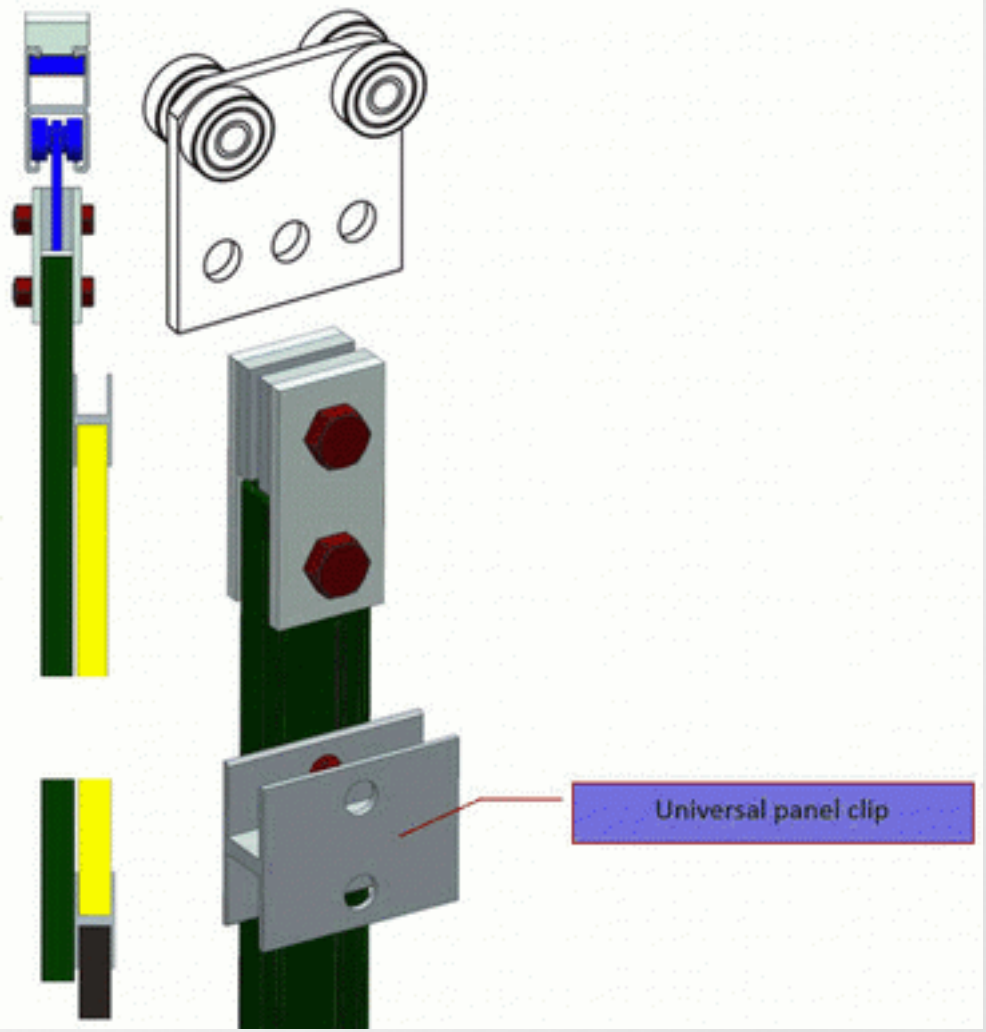
The two walls on either side of the MicroBooNE will be built on a 'sliding curtain' approach.

- Very tight area next to the stairwells.
- Panels to be hung in the work area and rolled into place.
- This approach yields a sturdy structure that is still able to move if access “through” a curtain should be needed.



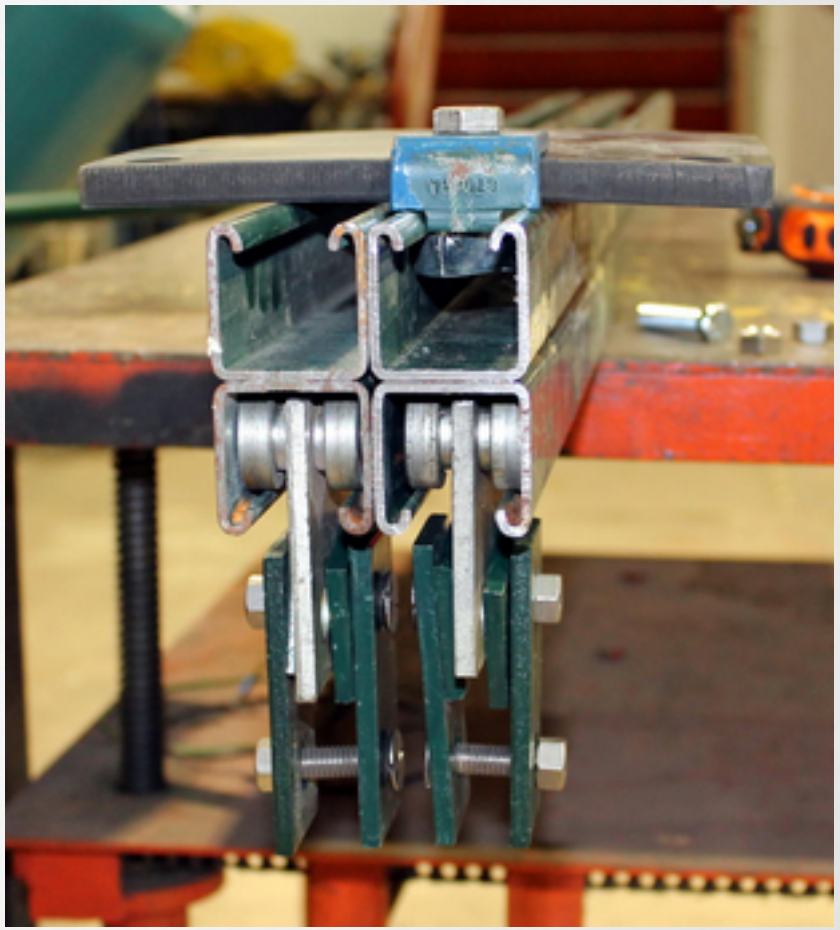
CRT: Phase A: Walls: Strategy

- Attach Unistrut rail to the i-beams of the platform.
- Insert roller into bottom facing channel.
- Hang long piece of strut to the roller.
- Attach panel to hanging strut with h-clips.
- Roll assembly into position.
- Lock roller with extra strut nut.
- Repeat.



CRT: Phase A: Walls: Strategy

- 270kg/rolle capacity.
- Minimum of 2 rollers per assembly.
- No assemlby heavier than 360kg.
- Possibility to install 3 rails for optimal stacking/layering



CRT: Phase A: Feedthrough Side

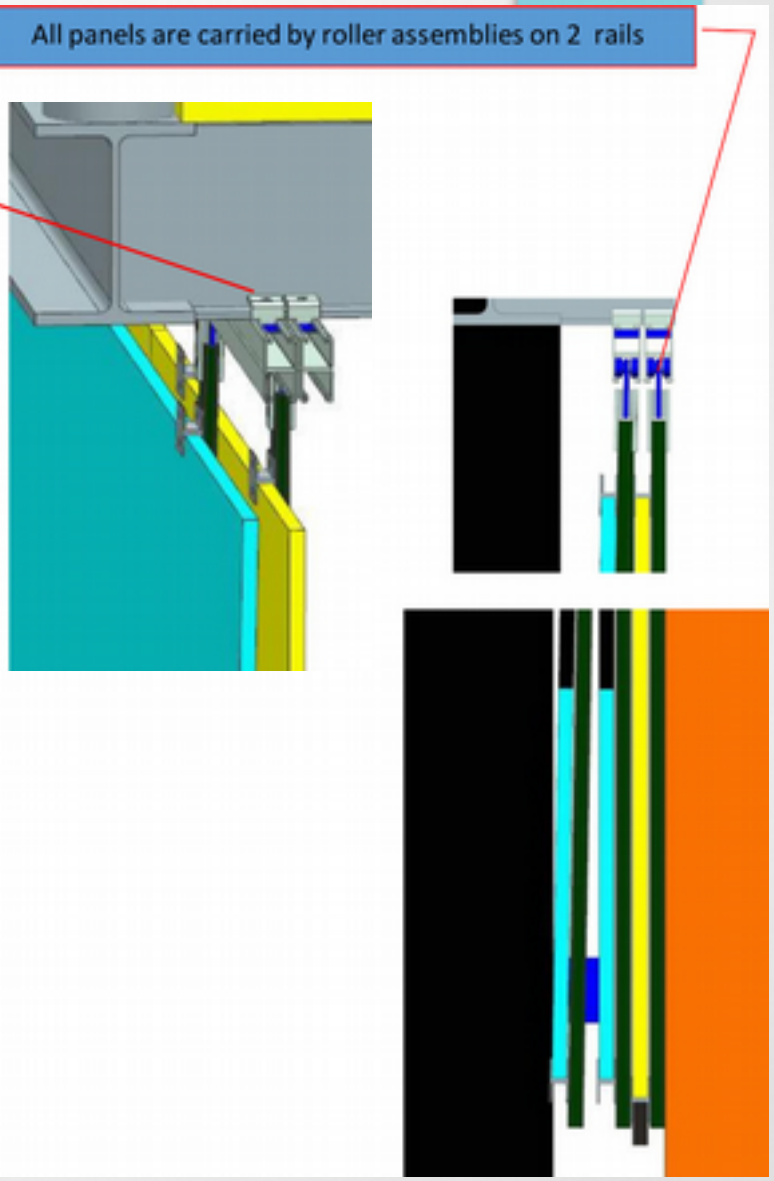
The feedthrough side is the smallest of the two walls.

- Presence of catwalk to access feedthrough limits height
- Existing piping limits length.
- Small size makes for simpler layering/stacking.
- First of the two walls to be installed.
- Work at height: <6m

CRT: Phase A: Feedthrough Side

Rails are clamped on existing cross I-beams

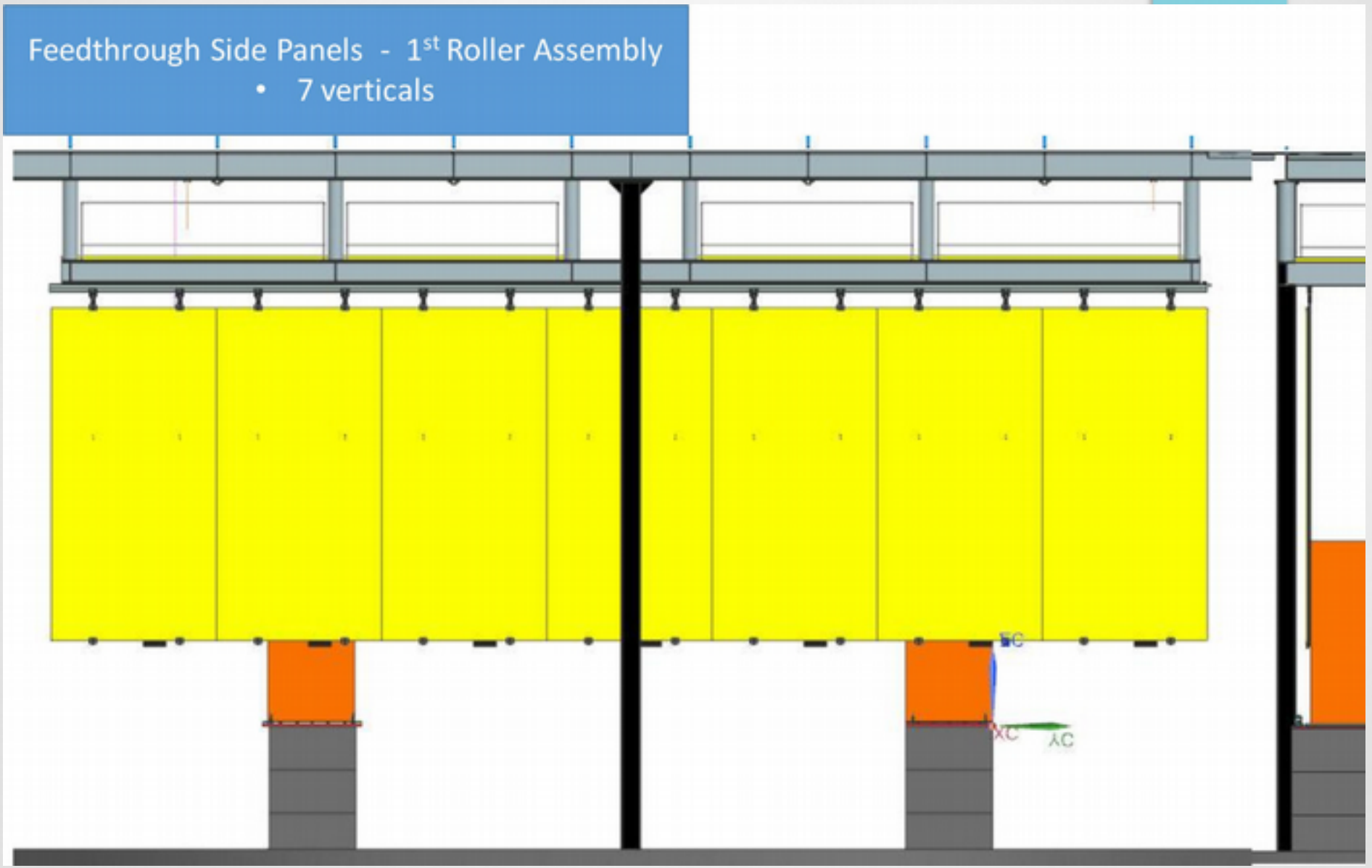
All panels are carried by roller assemblies on 2 rails



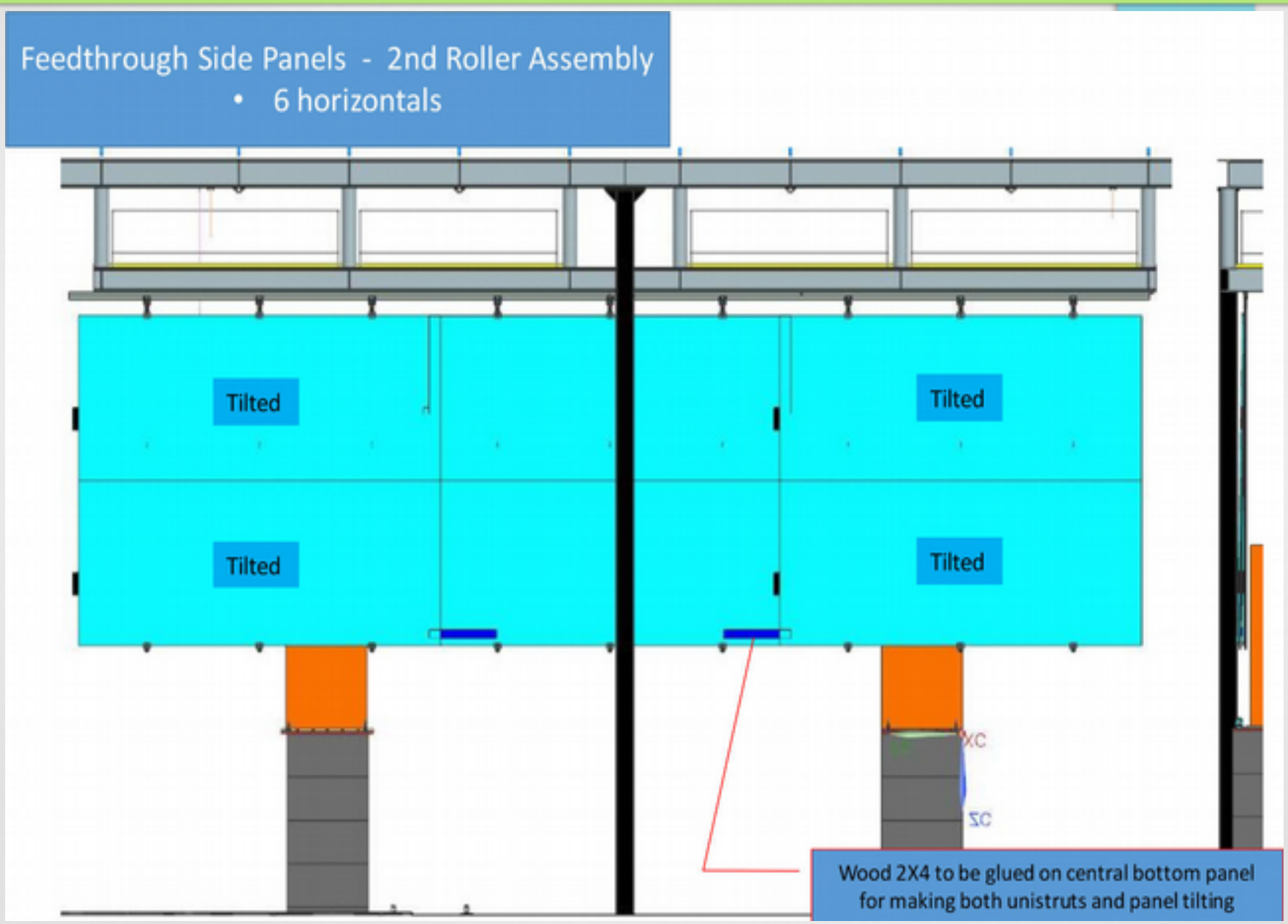
- Vertically oriented panels cover the full height of the feedthrough wall.
- Electronics (in black) boxes pointing downwards for easier access/service.
- 13 modules.

CRT: Phase A: Feedthrough Side

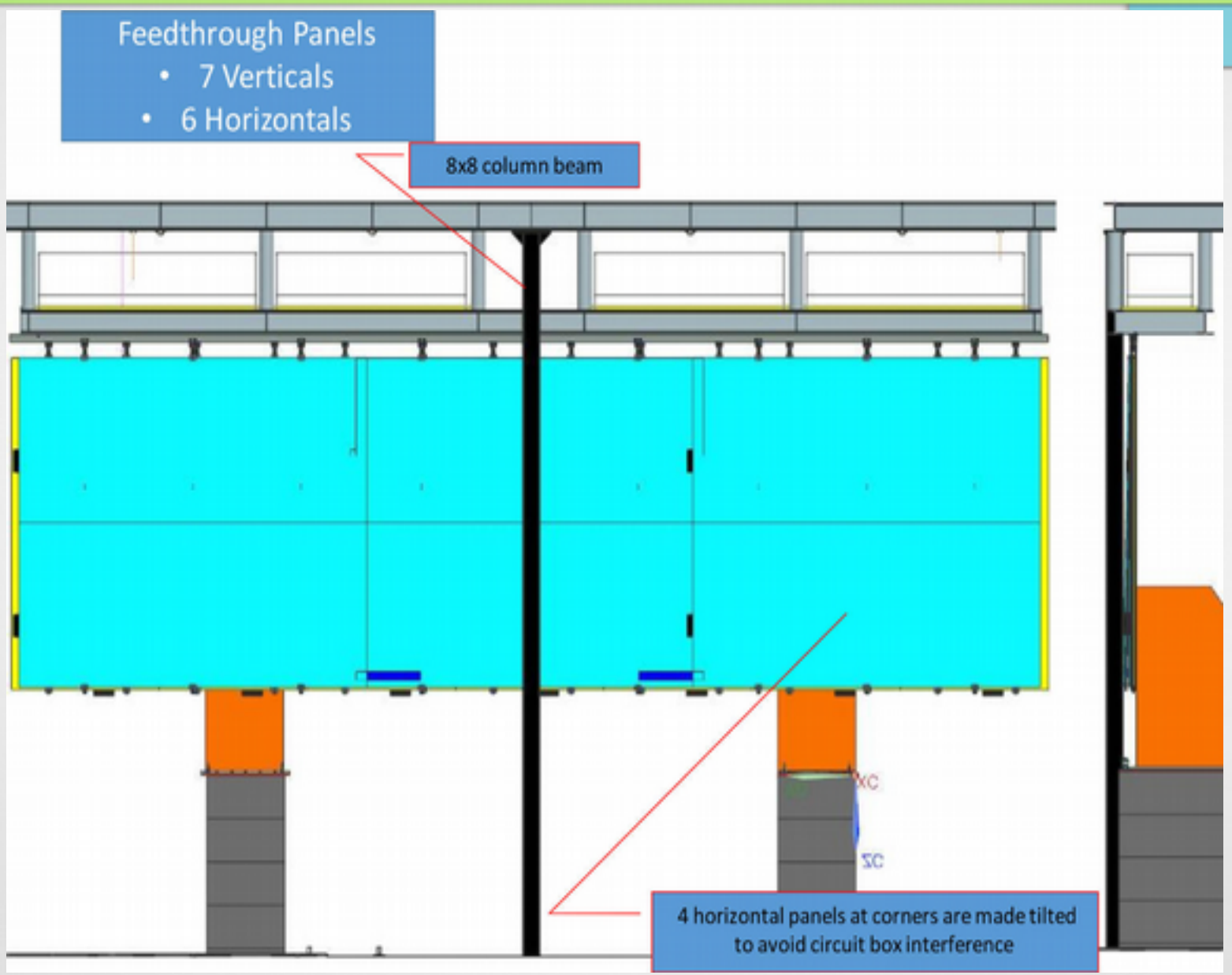
Feedthrough Side Panels - 1st Roller Assembly
- 7 verticals



CRT: Phase A: Feedthrough Side



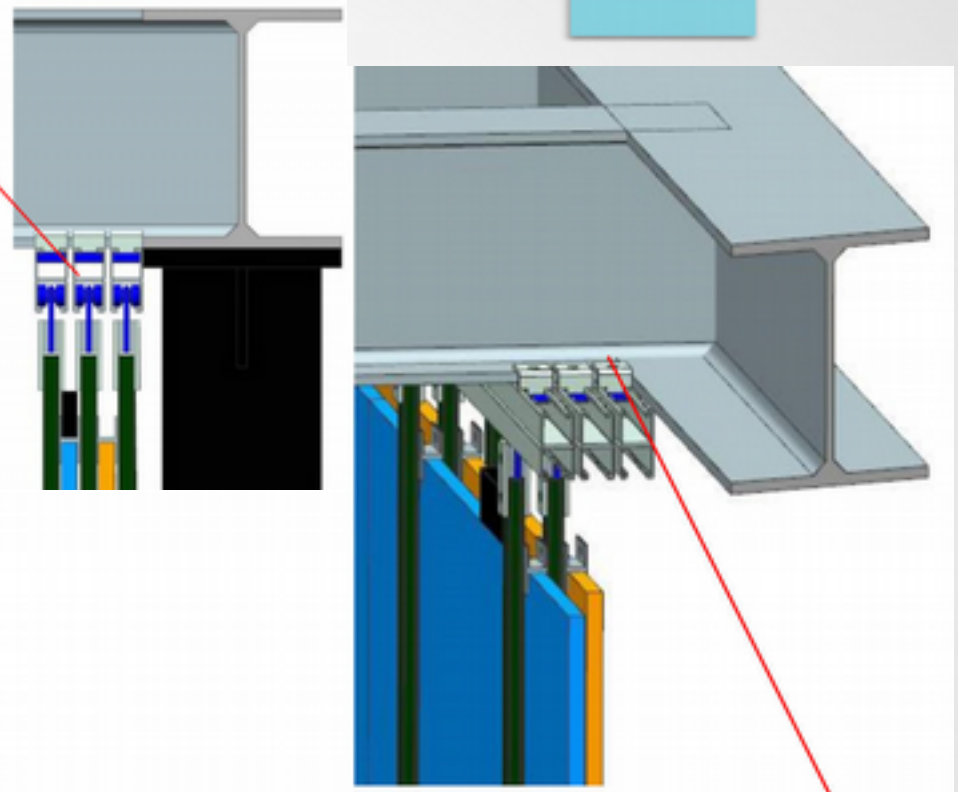
CRT: Phase A: Feedthrough Side



CRT: Phase A: Pipe Side

All panels are carried by roller assemblies on 3 rails

- The largest and most complex part of the CRT.
- Late correction forced rearrangement of existing material.
- High amount of stacking/layering. This is alleviated by the presence of a third rail on this side.
- Work at height: <7.5m

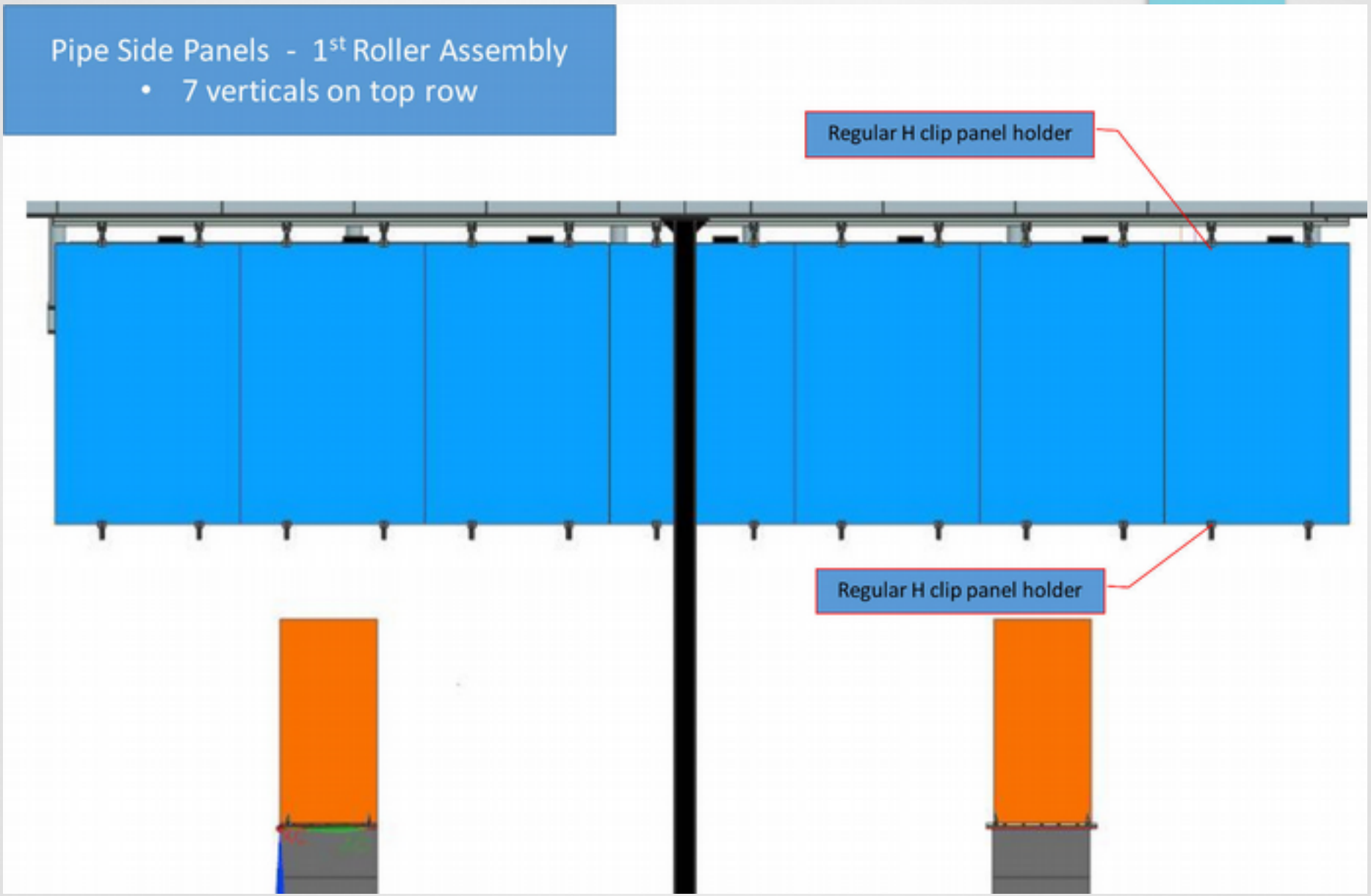


Rails are clamped on existing cross I-beams

CRT: Phase A: Pipe Side: Layer 0

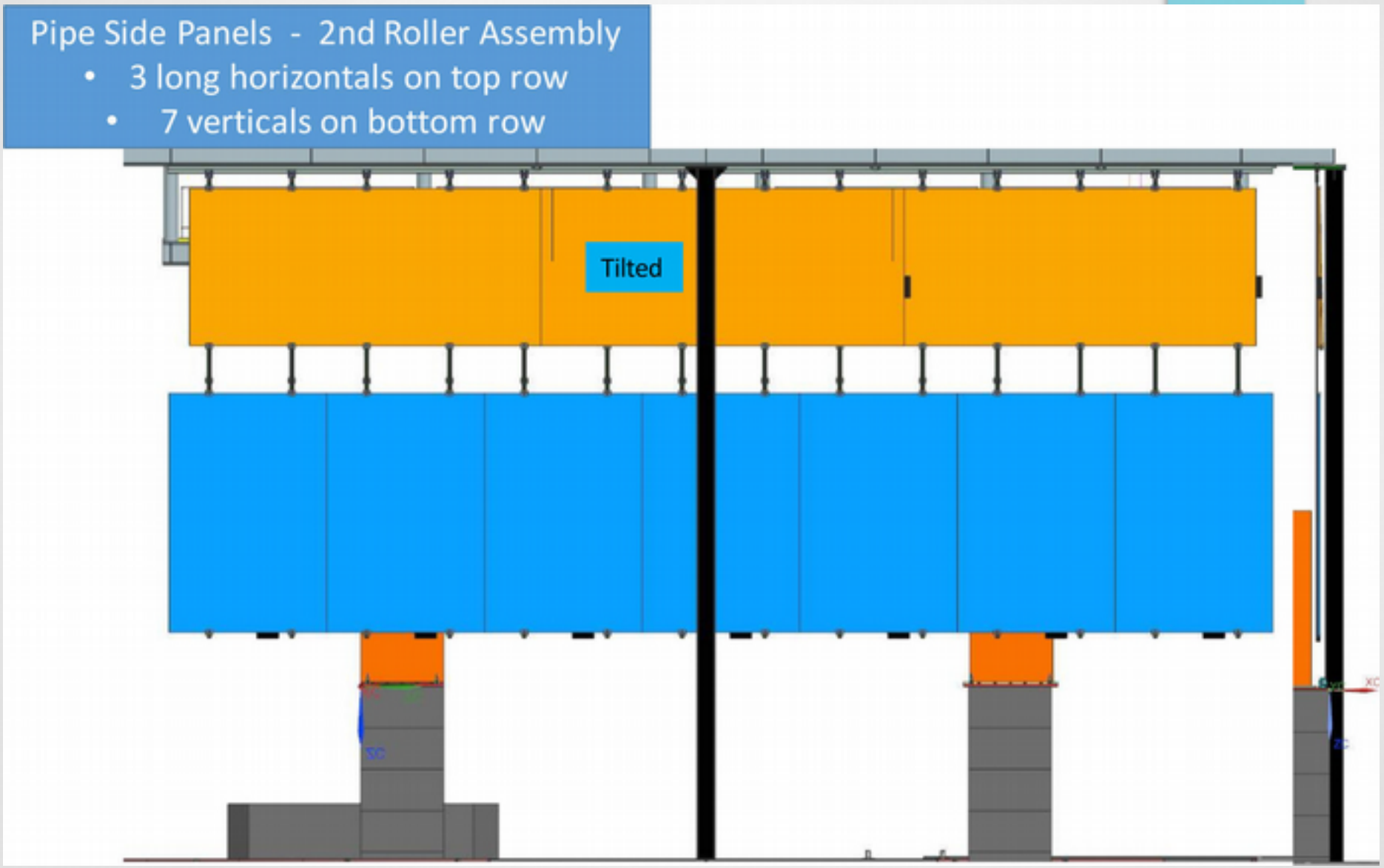
Pipe Side Panels - 1st Roller Assembly

- 7 verticals on top row

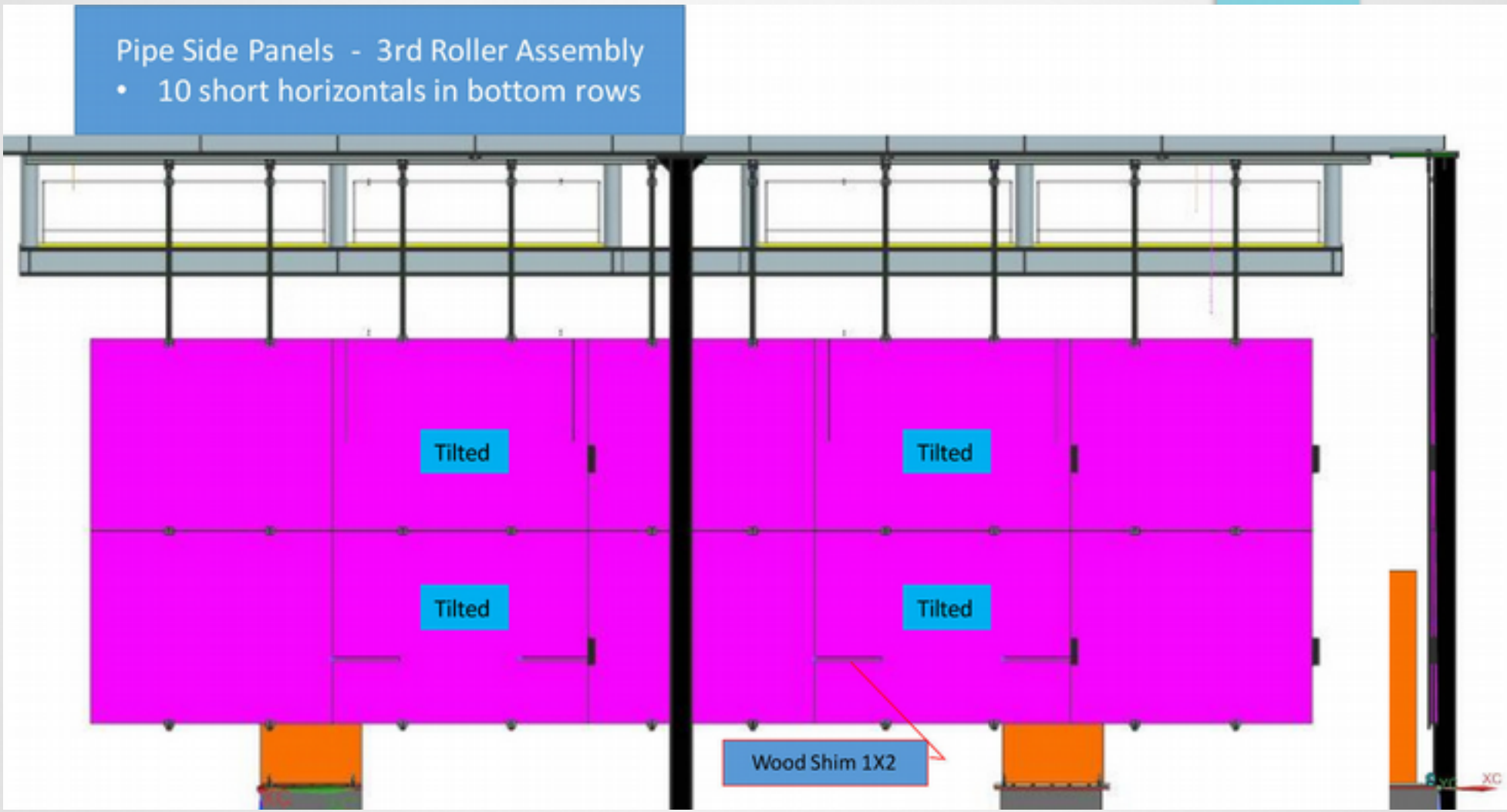


CRT: Phase A: Pipe Side: Layer 1

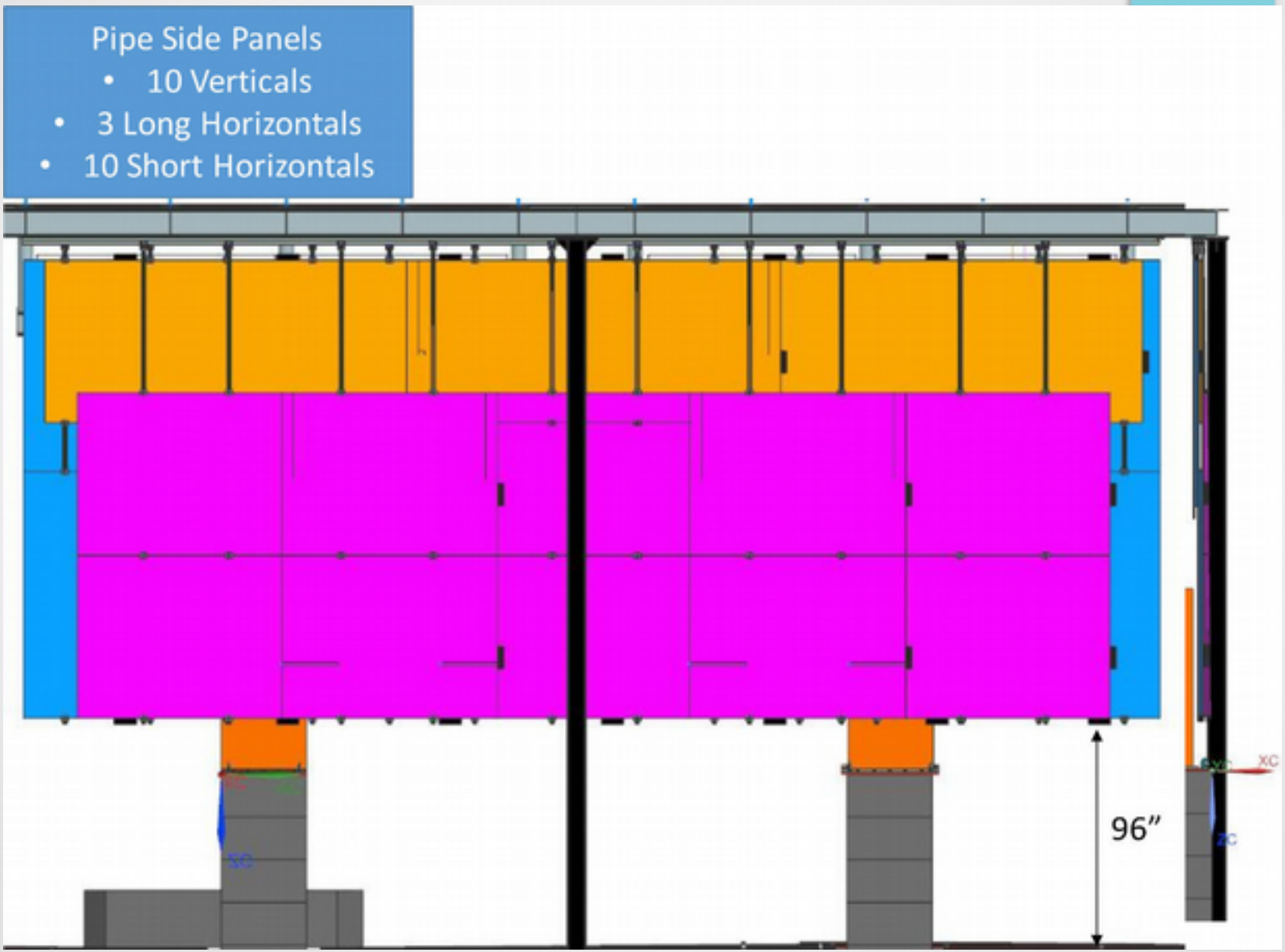
Pipe Side Panels - 2nd Roller Assembly
- 3 long horizontals on top row
- 7 verticals on bottom row



CRT: Phase A: Pipe Side: Layer 2



CRT: Phase A: Pipe Side



CRT: Phase A: Walls: Loading

	Weight (kg)	Weight (lbs.)
FT Horizontal	176	387
FT Vertical	152	334
Pipe Long	173	380
Pipe Short	101	222
Pipe Vertical	115	253

	# of modules	Total weight	# of rollers	Weight cty.	Remarks
FT Vertical	7	2338	14	8400	OK
FT Horz.	6	2332	9	5400	OK
Pipe Vert.	7	1771	14	8400	OK
Pipe H.+V.	3+7	2911	14	8400	OK
Pipe Horz.	10	2220	10	6000	OK

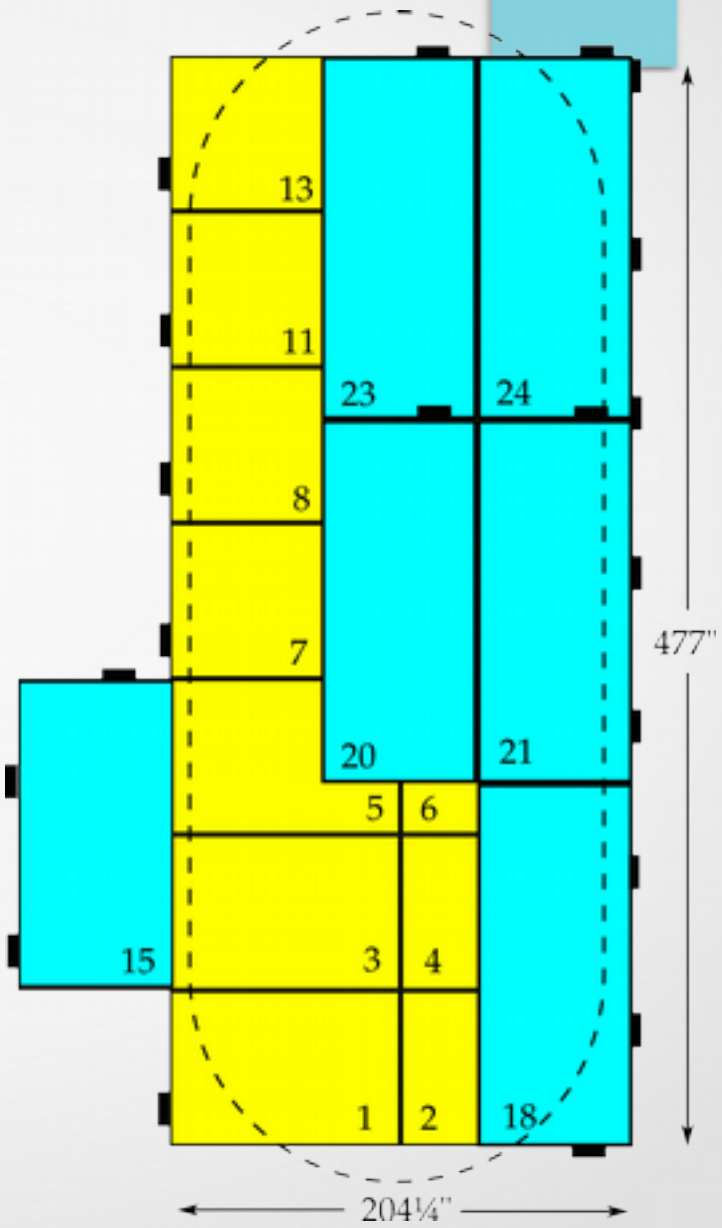
CRT: Phase A: Topside

The topside in phase A is only a structure to receive modules at a later time.

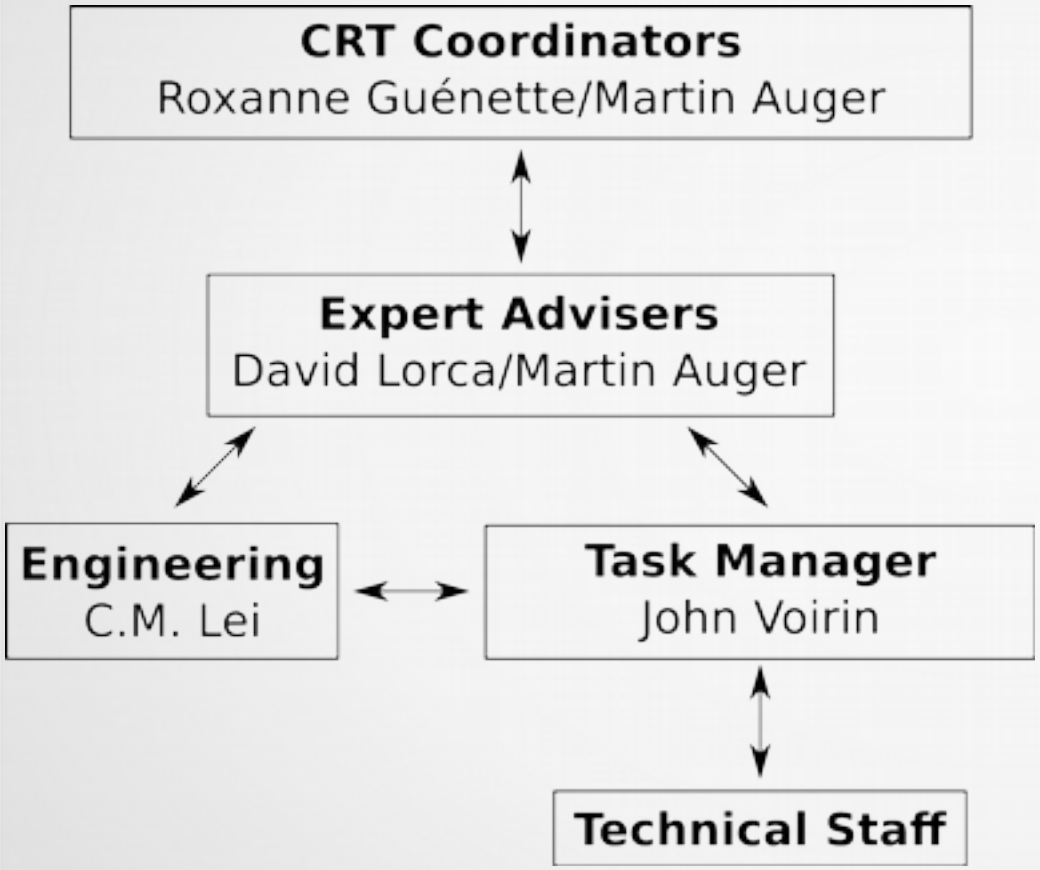
- This structure must be built during the shutdown since it attaches to the platform and necessitates operations to be halted
- Based on the design of the underside: Unistrut table resized to accomodate the top coverage.
- Expected panel availability: March 2017.

CRT: Phase B: Topside

- Easiest to install: crane single modules into position.
- Some panels are not represented as to not obscure the bottom layer.
- Only one extrusion over an access shaft in order to maintain crane access to te other.



CRT: Internal organisation



- With his knowledge of LarTF and experience, John acts as installation manager during the installation handling.
- Martin and/or David insure panel orientation, ordering, etc.
- Sufficient technical staff is key for rapid and quality installation.

CRT: Timetable

- Current hurdles to beginning work:
  - Buying material
  - Crane suction jig
- Soon as we have both material and jig, constuction/installation of underside can start; not tied to shutdown
- Shop preparation for walls and topside can also proceed in the shop before the shutdown.
- As soon as shutdown starts, remaining installations can begin; platform disturbances necessary.

CRT: Timetable

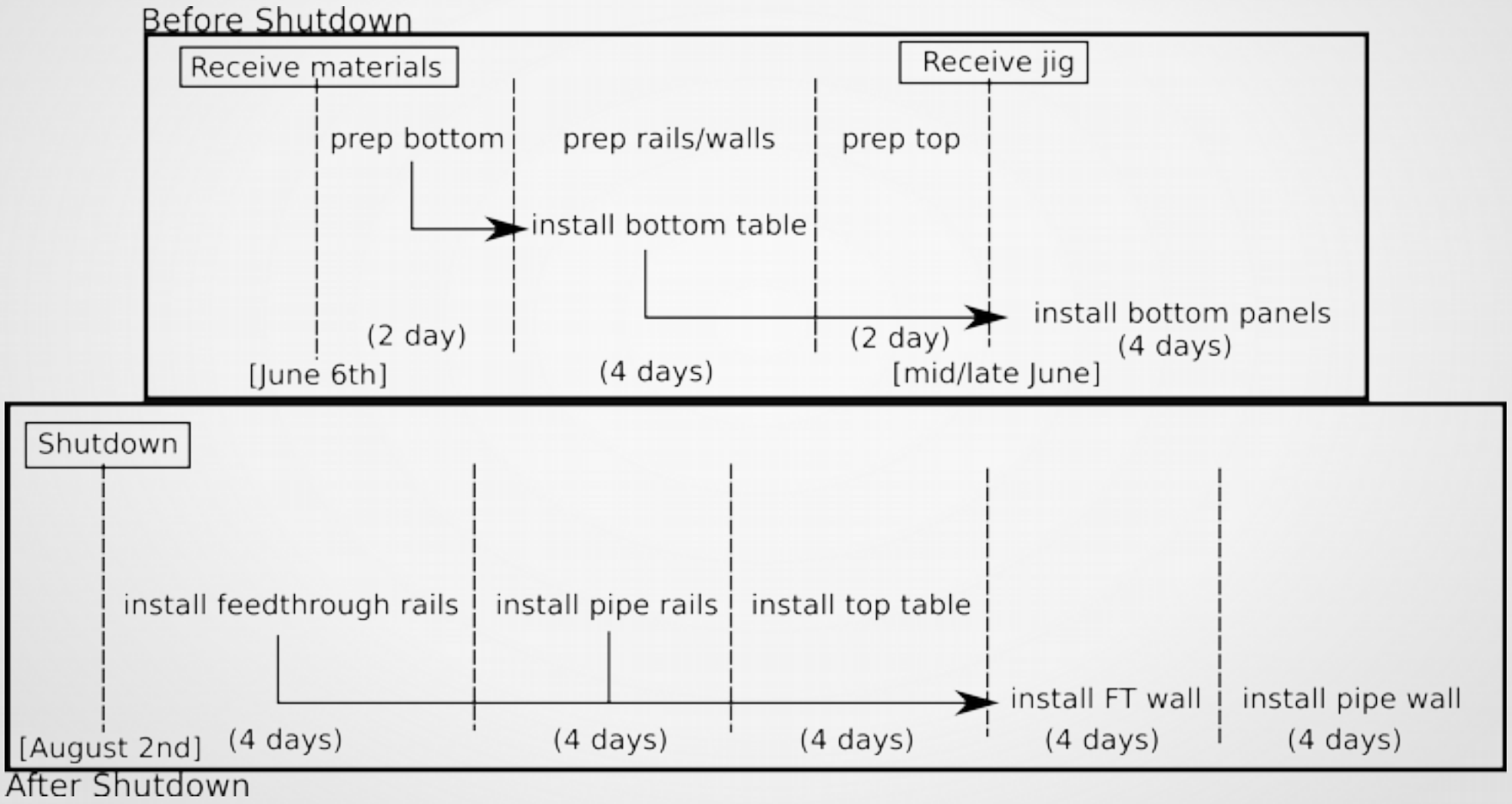
Breakdown of time necessary for the different work packages:

- Shop preparation (cutting, welding, pre-assembly):
  - 32 person-days [8 days at four technicians strong]
    - This is only tied to material availability; starts as soon as possible
- Structure installation (strut tables and rails in LarTF):
  - 32 person-days [8 days at four technicians strong]
    - Only the bottom table can be installed as soon as the material is available.
    - Wall rails and top table installation can only start at the shutdown; August 1st.

CRT: Timetable

- Module installation:
  - 48 person-days [12 days at 4 technicians strong]
    - The bottom panels can go in immediatly after the bottom table is ready
    - The walls can only go in after their rails are in place.

CRT: Timetable



CRT: Timetable

- We are not alone to require detector access during th shutdown period:
  - Several other MicroBooNE systems to be upgraded/tuned/checked.
  - Many of these require running acquisition computers on the platform -> incompatible with our project.
- Upgrade projects meeting on Monday the 10th to determine amount of access needed and resolve possible access conflicts between projects
- The tagger is the largest, most access-disruptive of the different upgrades and will have scheduling priority.

CRT: Safety

Considering the different safety concerns:

- Work at height.
- Large, oddly shaped, heavy objects
- Crane usage

It would be advisable that professionnal Fermilab technicians, with the proper training in those area, handle and install the modules.

John began drafting a JHA and is identifying all safety points (ie: having a backup structure in case of vacuum jig failure)

Cosmic Ray Tagger Installation Review

- Who will be doing the installation?
  - John Voirin and a team of technicians will be doing the actual installation handling. Martin/David will overview panel placement/orientation.
- Who is in charge (task manager?)
  - John Voirin
- How long will it take?
  - With a team of 4 technicians: 32 working days. Can be broken down to: 12 days before the shutdown and 20 days starting at the shutdown

Cosmic Ray Tagger Installation Review

- Is there a written plan?
  - Being drafted at the moment. Built on this presentation.
- Does the plan involve any welding?
  - Not in LarTF; it can all be done in the welding shop beforehand.
- How have all of the potential safety issues being addressed?
  - John is drafting the JHA document about these points: work at height, suction jig failure, crane operation, etc.
- What personnel resources from Fermilab are required for the installation?
  - Technicians and a crane operator. Experienced technical personnel with the training required to handle the working conditions.

Thank you from the whole CRT team!